JANUARY, 1941
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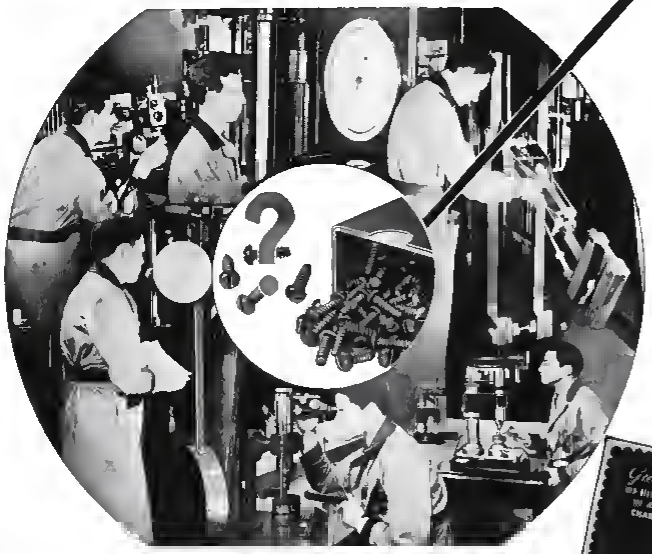
In This Issue
THE TRUTH ABOUT THE DEFENSE PROGRAM
by T. P. Wright

AVIATION

The Oldest American Aeronautical Magazine

WE'LL KEEP THE "Doubtful Few" OFF YOUR ASSEMBLY BILLS



Parker-Kalon's Unequalled Quality-Control Laboratory eliminates the extra costs built up by "doubtful" screws

Fastening devices cost little . . . when they work right. When they don't, they cost plenty! The "Doubtful Few" . . . the imperfect units in a lot that won't drive properly, or fail in service . . . carry with them a high bill for extra time and labor, interrupted work and customer dissatisfaction.

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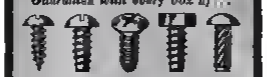
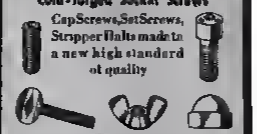


Hardened Self-tapping Screws
Types, sizes, head-styles for every assembly of metal or plastics

Cold-forged Socket Screws
Cap Screws, Set Screws, Stripper Bolts made to a new high standard of quality



Wing Nuts-Cup Nuts-Thumb Screws
Cold forged . . Neater, Stronger

Quality-Controlled **PARKER-KALON Fastening Devices**

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New Quietness in ALL PIPER '41 MODELS

Standard Equipment on All Three Models Includes a Stainless Steel

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INTRODUCED last year on the Piper Coupe, the noise-reducing, stainless-steel Piper exhaust muffler won instant acclaim throughout the aviation world. This year *every* Piper model—Coupe, Cruiser and Cub Trainer (except 40 h.p.)—will fly quietly with engine noise muffled to a smooth purr, thanks to this achievement of Piper engineers.

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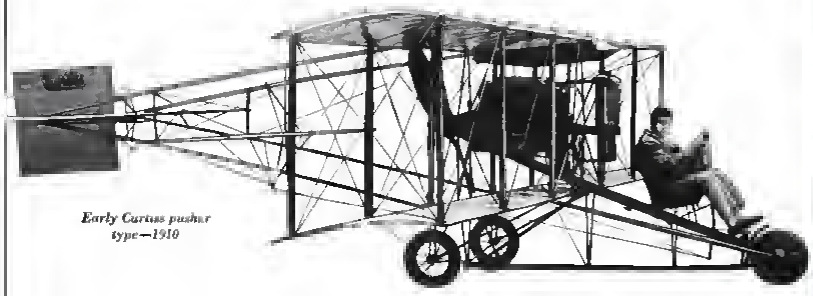
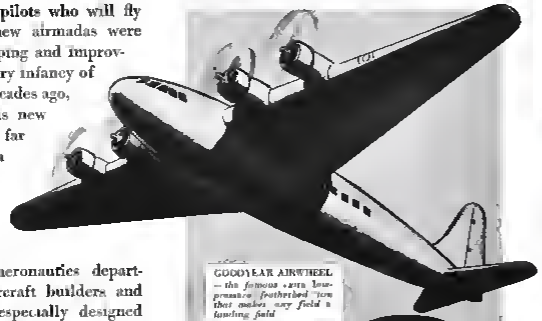


Early Curtiss pusher type—1910

First choice in 1910 and in 1941

Long before most of the pilots who will fly America's swarming new airmadas were born, Goodyear was developing and improving airplane tires. In the very infancy of aviation, more than three decades ago, Goodyear realized that this new form of transport presented far different tire problems from earthbound vehicles—that bicycle and auto tires wouldn't do!

So, in 1910, Goodyear instituted its own special aeronautics department to cooperate with aircraft builders and produced the wing tire, especially designed for airplane service. On this tire many of the earliest historic "first" flights were made. So, too, today many of the newest, biggest, fastest ships are 100%-equipped with Goodyear tires, tubes, wheels and brakes — *because Goodyear is still pioneering improved wheel gear.* If you have a problem, write: Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, California.



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He is one of a large corps of Eaton experts who test, check, care for and watch over every aircraft engine part, with skilled hands and eyes.

These men know the problems of the aircraft industry. They know the importance of defense work—the need for steadily increasing production. But they also know the rigid requirements of the industry—the importance of the utmost in quality—the need for the finest precision methods, the most careful inspection—and conclusive testing.

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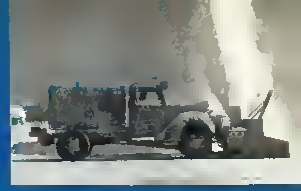
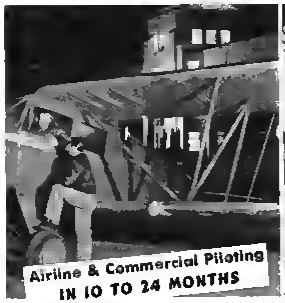


SNOGO

For Complete Snow Removal

—And many MORE!

THIS TRAINING *places*



Never before has the demand for trained pilots been so urgent as it is today. Airline expansion is actually being retarded because of the acute shortage of competently trained pilots. Flight instructors are in demand everywhere because of California Flyers' modern fleet and proven training. It is absolutely impossible for us to supply the requests for graduate pilots.

In aviation the Master Mechanic is the man responsible for the production, operation and maintenance of the world's great air fleets. At California Flyers the Master Mechanic student receives the practical training that prepares him for a position with airlines and aircraft plants. And it is this training that assures him immediate employment and rapid advancement.

Because the Aeronautical Engineering student at California Flyers trains in the center of modern aviation in America—in the city where half of the Nation's planes are engineered—he learns the latest not only in design and engineering but in modern plant procedure. Because of this advanced training the California Flyers graduate's services are in demand everywhere.

and WE CAN'T SUPPLY THE

Yes, you're that close to a position in aviation! Four months to 24 months from the day you enroll at California Flyers, depending on the course, you will be ready for a position in aviation, a position unparalleled in opportunity. And what is more important, a position is waiting for you for ***it is impossible for California Flyers to supply the demand for its graduates.***

Why does California Flyers put you in aviation faster? Here is the answer. From the day you enroll at California Flyers you are *in* aviation, preparing to do your share in the Defense Program. No time is wasted in unrelated, academic subjects. What you get is thorough, practical, industry training geared to the needs of the aviation industry and geared to the needs of our National Defense. What is more important, this training is specified training . . . specified by the industry to fulfill its needs.

California Flyers is not only located in the Nation's Aviation Capital but on the very airport that is the home of these famous aircraft plants

California Flyers is one of the few schools in the country that recognizes the vital need for specialized training, the need not only for Aeronautical Engineers, but for Aircraft Draftsmen—not only for Master Mechanics, but for Production Mechanics and Instrument Technicians—not only for Airline Pilots, but for Commercial Pilots and Flight Instructors. So it is that California Flyers gives you the opportunity of choosing a particular course that best suits your natural talents, and gives you the training which in a shorter space of time fits you for a career in the particular branch of your chosen field.

Why is there such an unprecedented demand for our graduates? An important reason is California Flyers location in the very heart of aviation in America, on the same airport with the plants of North American, Douglas-El Segundo and Interstate, on the very test field where the famous planes of Douglas, Lockheed, Northrop and Vultee have been tested and proved, in the city which is a terminus for United Airlines, Transcontinental and Western Air, American Airlines and Western Air Express. It is a school that is an integral part of this aviation picture. It is a school which through day to day personal contact works hand and hand with the industry, meeting the industry's personnel problems with men trained to its specifications. *Is it any wonder that this school cannot supply the demand for its graduates?*

California Flyers is not only approved by the United States Government for Flight and Master Mechanics Courses, selected by the Civil Aeronautics Authority for primary and advanced flight training, but it is one of the few schools chosen by the U. S. Army Air Corps to train its aviation mechanics. It is the school you, too, should choose.

CLIP THE COUPON ON OPPOSITE PAGE

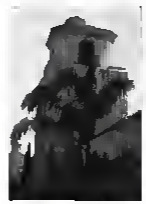
YOU IN AVIATION *in 4 to 24 months*

The Production Mechanic is the Aircraft builder. Because this is the largest field in aviation, the young man entering this branch has unlimited opportunities. At California Flyers the Production Mechanics student is trained to do not only one thing well, but all phases of production from metal forming to final assembly. It is this thorough training that takes him to the top.

Throughout every stage of planning and production the Aircraft Draftsman is the right hand of the men responsible for the successful design and engineering of the airplane. The young man enrolling at California Flyers receives training that is clear, concise and easy to master. Because of this thorough practical training the graduate's opportunities are unlimited.

With the increased use of instruments the position of Instrument Technician has become of vital importance. At California Flyers the student trains in an active maintenance shop. It is this type of training that prepares him for the many opportunities in the instrument field—a position in an aircraft plant, an airline, the Civil Service or he may operate his own business.

DEMAND FOR OUR GRADUATES



"I am a California Flyers Graduate." It means something to say that. It means that aviation wants you to the extent that over 96% of all California Flyers graduates are employed in the industry and there are consistently more requests for our graduates than we can supply. It is a passport into aviation. It means also that you are a man marked to succeed like the California Flyers men before you. And that is what *really* counts.

Write for new 64 page catalog, get complete information on all of California Flyers' aviation training courses, tuition and employment opportunities.

Why does a California Flyers man stand so high? It is obvious once you have heard the complete story of this famous school. Its founders believe that aviation should be taught in a school where the student remains an individual—learning aviation as it pertains to his individual ambitions and qualifications, and by so doing he is prepared for the responsibilities of leadership. This trains the graduate to meet today's aviation problems and to contribute to tomorrow's aviation advancement. This is the way today's leaders learned. Only this way can a training program be built for the industry, on industry specifications. They believe too that the entire field of aeronautics—engineering, mechanics and piloting are all closely interwoven and that a student should train in a school that teaches all of these important divisions. Above all, they believe that aviation should be taught in an environment of aviation activity, taught where there is the greatest number of men actively engaged in aviation. This is why California Flyers is located in the heart of the world's aviation capital on the world's busiest testing field.

If this is the kind of school you would like . . . friendly, efficient, modern and thorough, an aeronautical school operated by practical aviation men, you will be most interested in reading the *complete* story of California Flyers in the new 64 page catalog.

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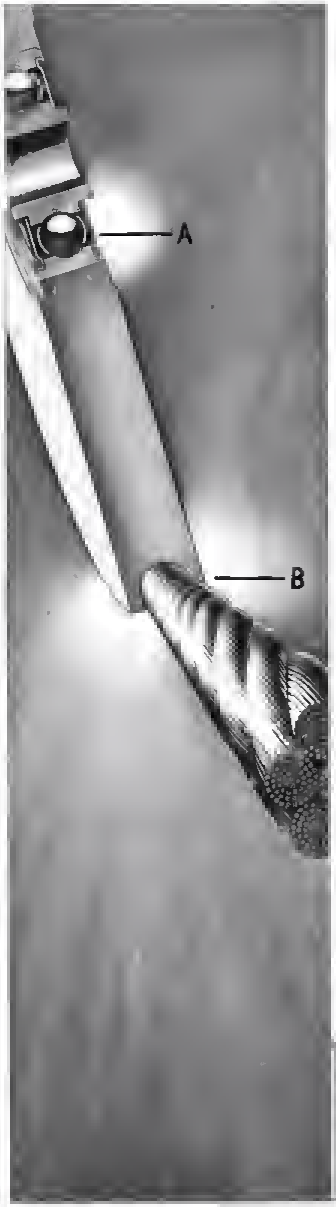
City_____ State_____



An Errar At "A" means A WOBBLE AT "B"

And a wobble at "B" means rapid wear on pulley flanges, uneven loading of balls in the bearing, low capacity and short life for control pulleys.

Be sure of minimum wobble at "B" by specifying Fafnir Control Pulley Bearings at "A"! In these bearings, fit between balls and races is closely controlled. Load is carried evenly by all balls, with resultant higher capacity and longer life.

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These details are important to you in the performance of your control pulleys, just as the hundreds of other extra values in Fafnir Aircraft Ball Bearings are important in the flyability of the whole ship. For the superlative quality which you and all other aircraft manufacturers have acknowledged for more than ten years, letter "Fafnir" at the right spots right on your sketches. Helpful literature and experienced engineers available on request. The Fafnir Bearing Company, Aircraft Division, New Britain, Conn.

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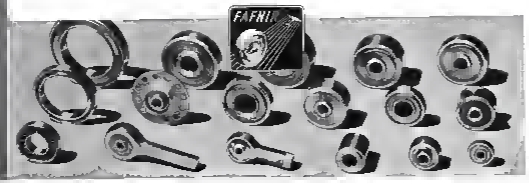
FOR AIRCRAFT ENGINES AND CONTROLS



The SPEED NUT — precision built of spring steel accurately heat treated — is engineered to surpass the threaded nut and lock washer. It is the only one piece fastening device that assures a double spring tension lock.

SPEED NUTS — hold bolts, screws, rivets and studs. They start on the bolt threads instantly, never shake loose and hold forever tight.

Manufactured for metal, wood or plastic applications. Over 700 shapes and sizes literally offer the proverbial pot of gold in assembly savings.

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● SPARTAN offers you the prestige of a famous aviation school fully approved by the U. S. Government for flight and mechanics training. It is located in the heart of the nation's greatest flying country. A $475,000 expansion program assures top rank training *plus* modern-to-the-minute advantages which lead to good jobs and advancement in aviation—11 new training planes—6 private practice fields—one of the most complete instrument repair, service and overhaul departments in the country with facilities for taking care of 125 airplanes currently in use in civilian and military fleets—24 modern buildings including four hangars, shops, laboratories, 14 classrooms—one of the most efficient new cafeterias in the Southwest—another new giant club-like dormitory to house an additional 180 men—an operating staff of 350 persons.

GET ALL THE FACTS about the advantages Spartan offers for the aviation career of your choice—Flight, Mechanics Engineering, Radio, Instrument Technician. (Next Semesters Start Jan 6 and March 31)

Mail This Coupon!

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Send me your new 1941 Catalog describing in detail the SPARTAN courses I have checked, also stating tuition and living expenses.

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Previous Education _____ 11.

CHECK COURSES YOU PREFER

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- ☐ Instrument Technician
- ☐ Airline Service Mechanic
- ☐ Commercial Pilot
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- ☐ Air Transport Radio
- ☐ Weather Analysis & Forecasting
- ☐ Aircraft Factory Mechanic

"Only producers can be strong; only the strong can be free"

The strength of the aircraft industry, currently contributed to America's rearmament program, stems not alone from skill in design and construction of advanced military aircraft. It also flows from the way these ships are being built ★ ★ ★ America was the birthplace of mass-production. For the first time in its short, vivid history, the aviation industry has been called upon to build great numbers of standardized models. Quantity production is changing to mass-production—a mass-production made possible only by an experience which started at the bottom with a single plane and explored, over the last 30 years, every step in a rapid, efficient manufacturing economy ★ ★ ★ Here in the MARTIN plant we are concentrating swiftly-expanding facilities on three principal types of military ships—a powerful new medium bomber for our Army, a long-range flying cruiser for our Navy, and a medium bomber for the British ★ ★ ★ Multiple moving assembly lines fabricate the aircraft by straight line methods so simplified that an ever-growing army of newly-trained workers produces with speed and accuracy ★ ★ ★ American manufacturing genius developed mass-production methods. Aviation is using them. The industry is undertaking to do in half the time what Germany took six years to do. We at the MARTIN plant take pride in the opportunity to help make mass-production of aircraft a reality—a reality that is creating the greatest air-defense the world has ever known.

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Martin

Builders of Dependable Aircraft Since 1909

TRADE MARK

THE AMERICAN'S CREED

A Summary of American Civic Faith

by William Tyler Page

I believe in the United States of America as a government of the people, by the people, for the people; whose just powers are derived from the consent of the governed; a democracy in a Republic; a sovereign Nation of many sovereign States; a perfect Union, one and inseparable; established upon those principles of freedom, equality, justice, and humanity for which American patriots sacrificed their lives and fortunes.

I therefore believe it is my duty to my Country to love it; to support its Constitution; to obey its laws; to respect its flag; and to defend it against all enemies.

The STORY of THE AMERICAN'S CREED

THE idea of laying special emphasis upon the duties and obligations of citizenship in the form of a national creed originated with Henry S Chapin. In 1916-17 a contest, open to all Americans, was inaugurated in the press throughout the country to secure "the best summary of the political faith of America." The contest was informally approved by the President of the United States. Through Mayor James H. Preston, the city of Baltimore, as the birthplace of the Star-Spangled Banner, offered a prize of $1,000, which was accepted, and the following committees were appointed A committee on manuscripts, consisting of Porter Emerson Browne and representatives from leading American magazines, with headquarters in New York City, a committee on award, consisting of Matthew P. Andrews, Irvin S. Cobb, Hamlin Garland, Ellen Glasgow, Julian Street, Booth Tarkington, and Charles Hanson Towne; and an advisory committee, consisting of Dr. P. P. Claxton, United States Commissioner of Education, governors of States, United States Senators, and other National and State officials

The winner of the contest and the author of the creed selected proved to be William Tyler Page, of Friendship Heights, Md., a descendant of President Tyler and also of Carter Braxton, one of the signers of the Declaration of Independence.

From the CONGRESSIONAL RECORD

The complete proceedings in regard to the official acceptance of The American's Creed may be found in the Congressional Record, No. 102 April 13 1918, from which is taken the following explanation of the doctrinal origin of the creed

"The United States of America —*Preamble, Constitution of the United States*

'A government of the people, by the people for the people.'—*Preamble, Constitution of the United States Daniel Webster's speech in the Senate, January 26, 1830 Abraham Lincoln's Gettysburg speech*

"Whose just powers are derived from the consent of the governed"—*Thomas Jefferson in Declaration of Independence*

"A democracy in a republic"—*James Madison in The Federalist, No 10 Article X of the amendments to Constitution*

'A sovereign Nation of many sovereign States' —*E pluribus unum great seal of the United States Article IV of the Constitution.*

"A perfect Union.'—*Preamble to the Constitution.*

One and inseparable. —*Webster's speech in the Senate, January 26 1830*

Established upon those principles of freedom, equality, justice and humanity for which American patriots sacrificed their lives and fortunes —*Declaration of Independence.*

"I therefore believe it is my duty to my country to love it.'—*In substance from Edward Everett Hale's The Man Without a Country*

'To support its Constitution'—*Oath of allegiance section 1757 Revised Statutes of the United States*

"To obey its laws."— *Washington's Farewell Address Article VI Constitution of the United States.*

'To respect its flag —*National anthem The Star-Spangled Banner Army and Navy Regulations, War Department circular on flag etiquette April 14, 1917*

And to defend it against all enemies —*Oath of allegiance section 1757 Revised Statutes of the United States*

THE B G. CORPORATION 136 WEST 52nd STREET NEW YORK, N. Y

A copy of The American's Creed (see overleaf) and The Story of The American's Creed suitable for framing, will be sent upon request

AVIATION

Established 1916

OLDEST AMERICAN AERONAUTICAL MAGAZINE

PROBLEM OF THE MONTH: Is anything wrong with aircraft production? T. P. Wright gives the answer in the leading article in this month's issue

CONTENTS

REGULAR EDITION — JANUARY 1941

AERONAUTICAL ENGINEERING AND PRODUCTION ARTICLES

Published monthly; price 25c a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription rates—United States, Canada, Mexico and Central American Countries, $3.00 a year, $4.00 for two years, $5.00 for three years. Great Britain and British possessions 30 shillings per year, 60 shillings for three years. All other countries, $5.00 a year, $10.00 for three years. Entered as second class matter September 8, 1936, at the Post Office, Albany, New York, under the Act of March 3, 1879. Volume 40, Number 1. Printed in U. S. A. Cable address: McGrawhill, New York. Member of A. B. C. Copyright 1941 by McGraw-Hill Publishing Company, Inc. 330 West 42nd Street, New York, N. Y. The following publications are combined with AVIATION: AERONAUTICAL ENGINEERING, AIRCRAFT JOURNAL and THE AVIATION NEWS. All rights to above names are reserved by the McGraw-Hill Publishing Co. Aviation is indexed in Readers Guide to Periodical Literature and in Industrial Arts Index.

FLASHES

picked up along the editorial airways

We Must Not Impair Our Airline System

» THE AIRLINES HAVE SCORED AGAIN with a new high record of progress for the year. All the figures are not in, but it looks like about a 60 per cent traffic increase over last year and black figures for all of the ledgers. Passenger traffic will amount to 10 percent of Pullman traffic, and about 15 percent of all first-class mail, and 25 percent of the transcontinental first-class mail now goes by air. Air express is gaining, but not spectacularly. Transport planes are full of emergency shipments for the defense program and a goodly proportion of airline passengers are traveling on defense business. Finally, the only safe or reasonable way to go to Europe or send a letter across the ocean is by air. All this has been accomplished with a flying organization consisting of slightly more than 300 airplanes and a few hundred pilots.

More than a year ago the lines foresaw the present equipment shortage and placed orders for their immediate needs. At the moment there are about 250 planes of all types on order and at least 300 more needed for normal expansion up to the middle of 1942. This number represents about 1 percent of the estimated objective of the defense program.

Early in December the airlines agreed to release equipment valued at about $7,500,000 and representing approximately one-half of their orders for the needs of the defense program. Specifically the Army wants 60 of the 110 DC-3s on order and the British want the engines. So the arrangement is for the airlines to take delivery on the remainder and return the engines to manufacturers for installation in heavy bombers for Britain. In effect, this means that the airlines will not be able to add equipment before the middle of 1941, and the British will be better off by a relatively small number of bombers.

Both the manufacturers and the airlines are cooperating fully with the Priorities Board of the Defense Commission in this action and are making their plans accordingly. From the manufacturers' standpoint it represents only a drop in the backlog bucket and will not accelerate defense production appreciably. From the airline standpoint it means some delay in expanding their services, but the situation is not too bad if further drastic action does not make it any worse than it is.

Perhaps the emergency is sufficiently grave to justify a relatively large sacrifice in our commercial development in order to give a little immediate aid to the British. Conditions abroad may even be so bad that we must take drastic action to insure that we continue to possess a land in which to operate our airlines. But in justice to the British and to ourselves, we must not further impair the second line of defense—our transport aviation. And we must avoid hysteria and look beyond to the day when airplanes will be used for peaceful pursuits rather than as instruments of war.

International

Donald Douglas, President and Board Chairman of the huge Douglas Aircraft Corporation, breaks ground for his company's new "blackest" factory at Long Beach, Calif.

« THERE'S A LOT OF TALK going around about our lagging aircraft production for the defense program. The newspapers are full of misleading interpretations of statements made by members of the Defense Commission. It's high time our readers had the facts, and we are putting them elsewhere in this issue. We are privileged to present beginning on page 30 a realistic and impartial appraisal of the state of our defenses and comparisons of the present and probable future strength of the air forces at war by T. P. Wright. The author is now consultant on aircraft production to the Defense Advisory Commission and took a prominent part in formulating the defense procurement program last summer. He is a manufacturing executive of long experience and Vice President of Engineering for the Curtiss-Wright Corporation. The present article brings up to date the earlier contributions by the same author in AVIATION for June, 1939, April, 1940, and July, 1940, but it goes far beyond. It is a thoughtful and thorough study of our whole defense problem and should be of prime interest to every citizen of the United States.

» THE THREAT OF NATIONALIZATION hangs over all industry and particularly that part of the aviation business concerned with defense manufacturing. There is legislation which vests in the President of the United States the power to take over defense plants and operate them under full government control. All that is necessary is to set an impossible objective, let the industry fail to meet it, and commandeer the plants.

This is a great power for any man. Like other great powers it may be used wisely or misused with tragic consequences. As long as it is used as a threat to keep the industry on its toes it is being used wisely. The minute there is any thought of actually nationalizing the industry it is not only ridiculous and tragic, but it jeopardizes all that is left of democracy in the entire world.

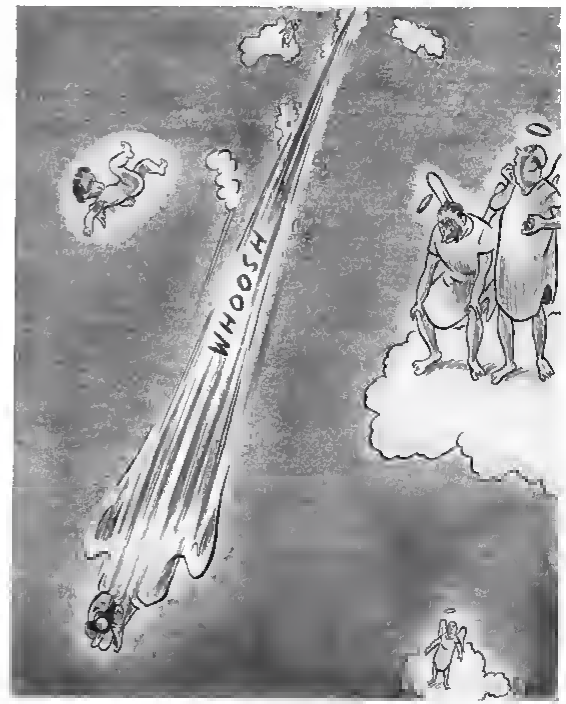
Nationalization led directly to the fall of France. When the step was taken in 1937, aircraft production fell to an all-time low of three warplanes in the month of August when workers were haggling about vacations and all decided to go away at once. The production rate never recovered under the Popular Front government and staggered along at about 200 a month until it was too late. Cost per pound of airplanes soared to heights unheard of anywhere in Europe. Standardization of products from government and private subcontractors was impossible. And by contrast the Germans saw fit to exempt their airplane manufacturers from totalitarianism and preserve for them a system of private enterprise with excess profit control much like our own today. As a result German production exceeded ten times the French production figure.

Nationalization of industry not only destroys initiative, cuts production and raises costs, but it robs the government services of key personnel needed for important defense jobs. No officer or executive of the Army or Navy favors it and many have gone on record as saying so. The mere thought of it is a grave injustice to the preservation of democracy.

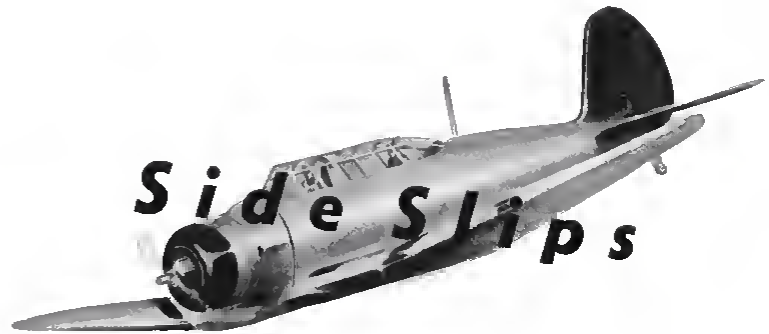
•

IT PAYS TO FLY

» ANOTHER DETERRENT TO DEFENSE is the labor unrest that is spreading through the manufacturing industry. We have no desire to see any man deprived of a just and equitable wage. But aircraft workers are not poorly paid. Most of them are young, unmarried men and many are on their first job. Government statistics show their average hourly wage is 74.2c per hour, as compared with 67.2c, for all manufacturing industries. Annual earnings are higher than those of workers in the automotive industry. Any increases in wage rates will come directly out of the taxpayers' pockets since most manufacturers are protected against them in their contracts. The additional cost of the present defense procurement program to the taxpayer under current demands for increases might easily exceed $500,000,000. This is going to be a bitter pill for 130,000,000 customers to swallow when the tax bills start rolling in.

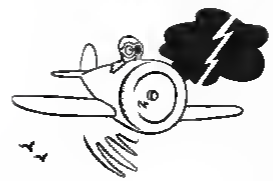


"Maguire claims he's now the fastest pursuit ship!"



Side Slips

» MOST great tragedies have their moments of comedy relief, and here is one from the Lovettsville accident. There was so much talk about lightning that a lot of people got to thinking on the subject for the first time. One fellow, we guess he must have been an ingenious pilot, sent a suggestion to the CAB Safety Board. He pointed out that lightning blinds a pilot for a few moments, during which he may hit something if he's down low. Therefore, when the juice is flashing, you should fly with one eye shut. Then you simply open the other one, which isn't blinded.



Maybe this man has got something. How about a pair of blinders—goggles with black disks for lenses—fixed so when one was open the other would be shut. It's our invention but you can have it.

» ANOTHER wistful little tale about the Lovettsville accident. You might not appreciate it unless you've been a press service correspondent in a village where nothing ever happens that the wide world wants to hear about. Well, suppose you were. And one day a great airliner full of important people comes along and piles up and all of civilized man turns his eyes your way for a few brief hours. You certainly will make hay. You hear about the manila envelope that fluttered into the hands of some farmers. The envelope came out of the plane, beyond all doubt, but how did it *get* out? Why, the stewardess *threw* it out, of course! And, why yes, of course, she knew the plane was going to crash and she wrote a note on the envelope! What a story! You write it, and the telegraph cables hum, and crowds push to buy the paper in far off cities. Well, a correspondent in or about Lovettsville did write it, and it took the harried investigators an hour or so to find out that there was nothing written on the envelope.

» YEARS AGO, when we were young and hopeful, we used to collect newspaper stories about aviation, paste them on the letterhead of a first-rate transport company that we worked for, and send them back to the editor. On the wide margin thus provided we wrote detailed corrections of mistakes, some times as many as fifteen or twenty in one stick of breezy Sunday reading. Only one editor ever replied, or, so far as we know, paid any attention to us. Those were the days when aviation writers believed, and wrote that if the engine quit the airplane fell; that, due to negligence on the part of operators, passengers were not given parachutes, that planes fell into air pockets and smacked the ground. For years the stories didn't seem to get any better. Then a few papers got themselves aviation reporters, and there came a day when quite a few of the air reporters had been up in planes. Four or five of these writers got to be real authorities on the business, men like Deke Lyman and C. B. Allen. Now, there must be around a hundred professional aviation writers. A few of them are serious students of the aviation art. But not enough. And some papers who do have good air writers don't bother to check their editorials with said writers. The other day one of Washington's best newspapers gave lead position to an editorial about this year's three accidents. The writer showed plainly that he knew nothing whatever about airlines or about the accidents. He said that, fortunately, the accidents were being investigated, as if possibly they might not have been. It sounded like old times.

» ONE TIME we had an automobile that got spells of not starting for weeks, no matter how vigorously we cranked it. Then for a while it would go if we just turned the switch on—starting "on compression", they called it. Once, standing in the hot sun, it started all by itself. In the winter it had no good spells at all. It simply would not go unless we filled the radiator full of boiling water and squirted ether in the priming cocks. That car was no good for business because it was undependable, but it was swell for joy-riding, never a dull trip. A million people bought cars like that one. And you would think that some people would want airplanes now, just good for going up and loafing around the clouds of a Sunday afternoon—sort of box-kite plane that would fly slow and easy. Right after the war somebody told us the French had a plane with big wings and a little engine that landed at 18 m.p.h. We always wanted one of those planes. But apparently nobody else wants one. They tell us that airplanes must fly far and fast and get places against head-winds. How about staying home and taking the engine apart on windy days? That's what we used to do with that car, on *rainy* days.

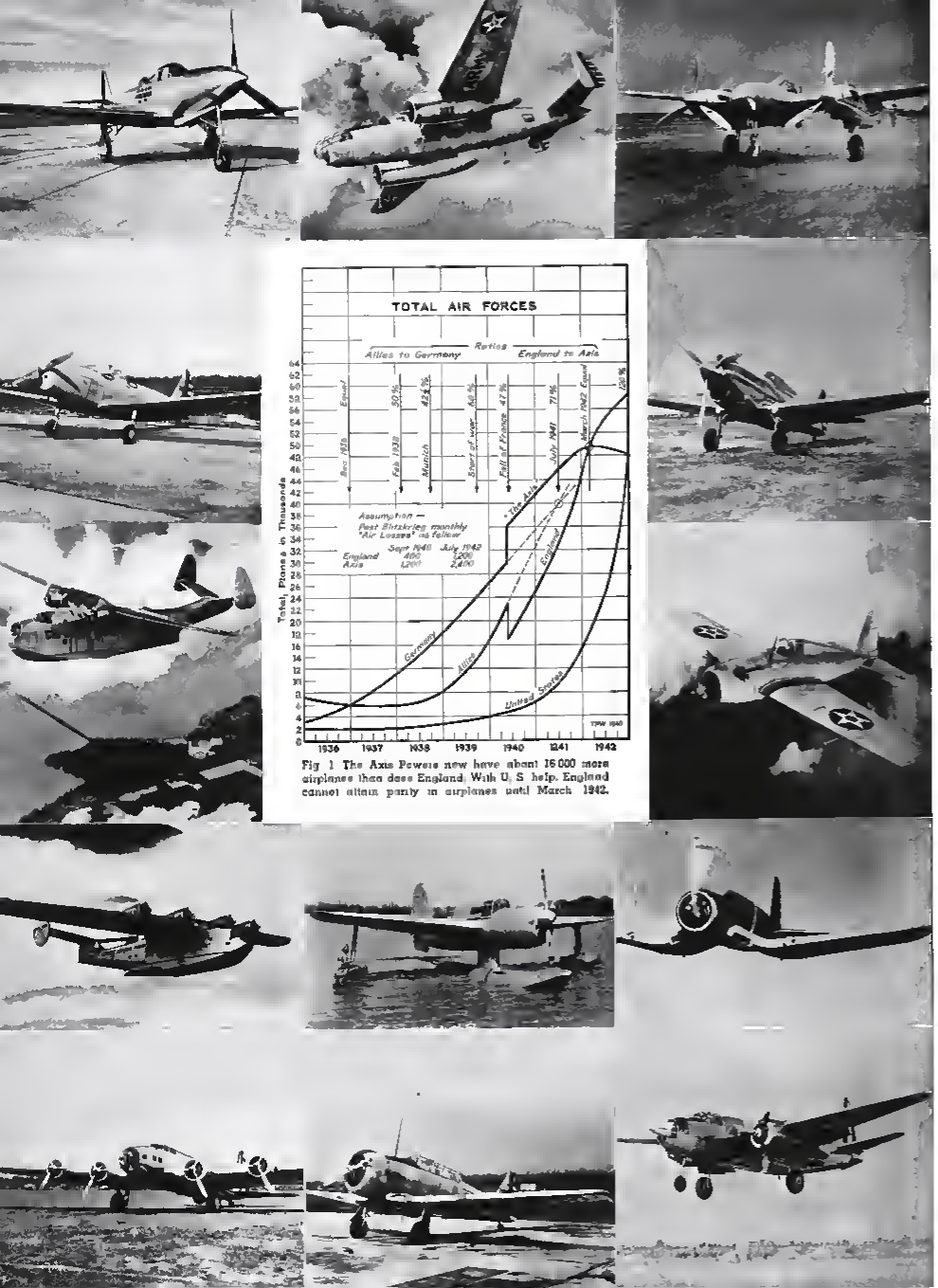


Fig. 1. The Axis Powers now have about 16,000 more airplanes than does England. With U. S. help, England cannot attain parity in airplanes until March 1942.

THE TRUTH ABOUT OUR *National Defense Program*

Why our aircraft production has lagged—and how much

By T. P. Wright *Vice President Engineering, Curtiss Wright Corporation Consultant National Defense Advisory Commission*

★ **At a time when accusations concerning the national defense program have come from all sides, here is a cool, impartial appraisal from one of the nation's outstanding aircraft manufacturing executives who has taken an important part in formulating our defense program.**

WE are, I believe gradually reaching a realization of the fact that we will be called upon to an ever increasing extent to defend our democratic way of life, our bill of rights, our freedom, and our right to consider every human being as someone of importance in himself, someone having an individual dignity, and the right of determining his own course in life, and not a mere cog in the machine of State —a robot. Furthermore, we are to some extent, and must in the immediate future become far more appreciative of the need of sacrifice in order to retain these things, and continue to improve the conditions of our society. Our form of government, social relationships and economic system are far from perfect, but they represent a step forward from what existed before our nation started its independent existence, and they give an infinitely better base for further development than the retrograde, totalitarian concept of society which now confronts us. Effective national defense is an immediate insurance policy for a continuation of our course.

And yet, taking a longer view, some form of collective security holds the greater ultimate promise. By such means the burden of arms expense can be less unbearable, permitting the release of our energies to more constructive efforts. The concept of collective security revived by us after the last war, accords well with our early history wherein it was demonstrated that "in union there is strength." Starting with a close association between the English-speaking countries, expanding as organization is perfected, and defending it by a preponderance of air power, overwhelming when compared to any combination of opponents, such a group, federation, league or union as it may alternatively be called, has the optimum of potential good to offer.

National Defense Fundamentals

The character of total national aggression is such as to make necessary a total national defense. Steps short of this cannot succeed. "Total" anything is difficult in a democracy, as it of necessity must entail considerable encroachment on personal liberty. A basic problem is how to insure retention of an essential minimum of individual rights during a period when there must be a great increase in national direction of effort. The example of England shows it is possible.

Total national defense involves *two major considerations*, the one psychological in nature, the other material. The latter can only be attained sufficiently if the former very generally prevails. The psychological factors involved, as I conceive them, are the following:

Psychological Factors

First, a realization by the people that there is in our situation a real peril. We either are or are not threatened. If we are and if we all agree we are then we can expend the necessary effort to defend ourselves; if we are not, then we are about to waste an incredibly large amount of effort and money, and probably very inefficiently, besides. Consideration of three things leads one to conclude that we are in danger. One is the history of aggression of the past several years, another, the situation on the seas, and the final one is consideration of a map of the world, greatly shrunk by the advent of air power. Let us briefly study these three things that contain a threat for us.

As to *recent history*, 1917 found the world at war with us unprepared. In 1919 the war was over, a League of Nations was being formed for the purpose of perpetuating peace with a united effort, and we were deciding effectively to defeat this effort by refusing to join the organization we had initiated, a group composed of allies with whom we had fought. An irreparably grievous and uncourageous decision! During the 1920's, a general disarmament took place, a course only justified if carried through coincidentally with the development of a strong and thriving League of Nations. Then aggression commenced. Japan seized Manchuria in 1931, unopposed by the other nations, (England refusing to join us in a strong protest), Hitler came to power in 1933 heralding his future course by marching into the Rhineland in 1934 (France and England could then have stopped him), Italy without provocation attacked and conquered Ethiopia in 1935 (wholeheartedly applied sanctions could have stopped this aggression), the dictator nations used Spain as a proving ground for their weapons in 1936, Japan committed a brutal aggression against China in 1937, gradually slaughtering her way inland; then in 1938 Germany assumed the aggressor's role in Austria and Czecho-Slovakia and appeasement was in full swing (by

then, however, Germany, supreme in the air as many of us had warned, was not bluffing and possessed such preponderance of air power superiority that there was much justification for the Chamberlain policy) next Italy seized Albania early in 1939 and finally later that year Germany's blitzkrieg on Poland set off the war with the rapidly mounting list of conquests of 1940—Denmark, Norway, Belgium, Holland and France, then Italy jumped on the bandwagon to claim some spoils, believing she could get them without having to fight much for them. A destructive and indiscriminate air attack against England is now under way (delayed for two irretrievable months in so far as German success is concerned). Italy attacks Greece with no grievance as justification and finally, by threat, Germany advances in the Balkans.

Surely, this glance at recent events of history should show us that our danger is very real and that immediate preparation for any eventuality is essential. It shows that aggressors can never be appeased or satiated. It shows that no single nation can indefinitely defend itself against well prepared and unscrupulous aggressors and that national policy must be backed by strength either of its own arms or in combination with its allies. Unprepared, we have reason to fear for our own safety.

The next factor contributing to our peril has to do with *naval strength*. Very roughly, relative naval strengths are as follows: Germany plus Italy, 1,150,000 tons; Japan 1,000,000; Russia 500,000; France 700,000; Britain 1,650,000; United States 1,450,000. From consideration of these figures it can be seen that England and the United States can together dominate the seas. With Britain in action and with but 20% of our fleet in the Atlantic, we have a 20% margin over Japan in the Pacific with Britain's fleet destroyed or otherwise out of action we would face potential enemies in the Atlantic with but 73% of their strength and have but 70% of Japan's strength to pit against her in the Pacific with Britain's fleet added to that of the Dictators, these proportions would be 30% and 70% respectively. This indicates a real peril and an overwhelming need for doing everything in our power to back up Britain's gallant fight.

Now let us see why the *navy of the world* and the advent of air power should give us concern. The latter has caused the former to shrink. It is very generally admitted that we must expand our defenses to the whole Western Hemisphere, but part of this, South America, is closer to Africa than to us. An aggressor-controlled Africa thus imperils us by way of South America. Furthermore from Europe—Iceland, Greenland and Newfoundland are air-stepping stones to New England. The Azores and Bermuda are in a somewhat similar category—attested by the use our own Pan American Clippers make of them now.

These then are very real reasons for justifying a realization of a very real peril and one which could be immediate. Our natural resources, in a way, increase the peril as they increase the incentive of capture for those whose covetous eyes may look our way. The element of time makes national resources only a strength if they are developd into weapons of defense. Potential strength cannot contend with arms in being.

The *second psychological factor* which must back up any real effort in securing adequate national defense is that intangible thing—morale. This implies a hardening of our moral fibre, a determination to sacrifice a normal, comfortable way of life and to work increasingly and uncomplainingly to attain the desired end. Our national softness is much commented upon these days. Such condition cannot form a part of the character of a nation re-arming as we must do. Self discipline is necessary. We must recognize the degree to which sacrifice, even though to some extent enforced, has made possible the re-arming and

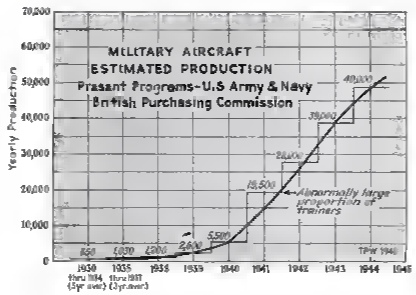


Fig II Yearly production of military airplanes in the U S and estimated future productio

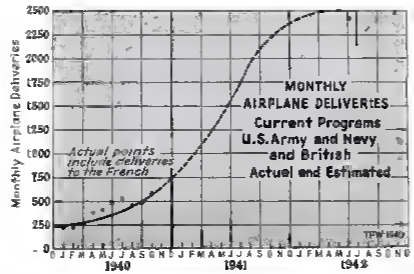


Fig III Monthly military airplane deliveries by U S factories since January 1940, and estimated future production.

conquests of Germany. We must exert a similar, though self-imposed discipline upon ourselves. Two years ago in England, Anthony Eden said: "But here again we are up against a fresh set of difficulties—that it is not possible greatly to accelerate the present rate of re armament unless we take certain steps to mobilize industry—such a step as hitherto we have only been willing to take in time of war." We here in America must take these steps now as England should have earlier.

The *third factor* of this kind is a general willingness to *pay the price* which is involved. It has been estimated that throughout the past several years, Germany has each year expended 30 percent of her national income on armaments. Similarly, England has expended 12 percent and France 10 percent. On the basis of present appropriations, our defense expenditures will approximate but seven percent of our national income. A greater amount is believed necessary. We must squarely face these unpleasant facts, and with them before us, willingly tackle the job.

The *fourth factor* to be faced is the need of increasing *government efficiency*. We cannot afford to waste time and bungle along as we have so much heretofore. This is especially important with the necessary increase in direction of affairs which government must assume. Government inefficiency rightly bears the brunt of industry's criticism of federal regulation and justifies its fear of any type of government operation. In this regard, again, the example of Germany is worthy of our attention. Apropos of this, Sir H. Hartley said in London in 1938, when England

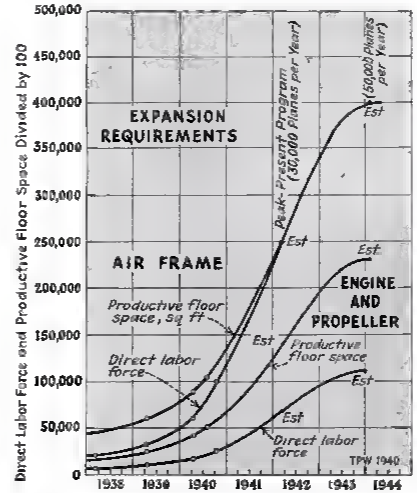


Fig IV. Expansion requirements for air frames engines and propellers in U S factories for 50 000 planes per year.

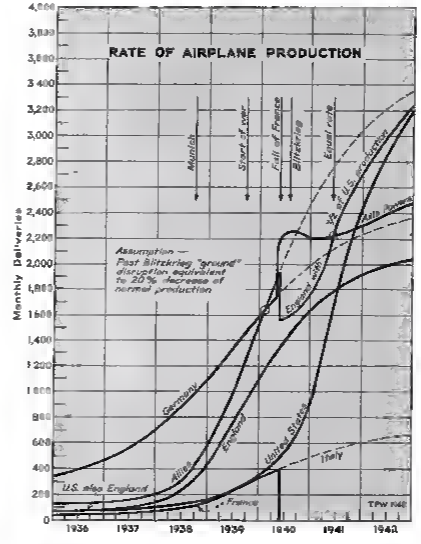


Fig V Rate of airplane production. If England receives one-half of U S planes, she will match the rate of the Axis powers about mid-1941

war in a comparable position to ours. "The outstanding points were the great increase in the scope of functions of government and the extent to which planning on a national basis has come into existence."

The *fifth need* in establishing a satisfactory psychological background for an effective defense effort is *economic*, specifically, the necessity of composing economic difficulties. We cannot tolerate holdups from strikes of labor or from sit-downs of capital. Rather there must be built up on the part of all classes a desire to cooperate, a willingness to arbitrate differences and a determination to move forward to attain ends of common advantage. Labor leadership of the type England has in the person of Ernest Bevin is sorely needed. More altruistic leadership within industry, of the character being given by great industrial leaders who have been serving on the National Defense Commission, such as Mr. Stettinius and Mr. Knudsen, is necessary. As the latter recently said: "The defense job to my mind has not been sufficiently sold to industry and labor yet."

Finally we must, as a team, acquire the *will to win*. Contemplation of conditions that would exist under a Pax Germanica should help this spirit. Conditions cannot be expected to differ from those now present in conquered nations of Europe, if our turn should come. The Nazi philosophy frankly envisions a German world domination with other peoples as subjects. Hitler's November 10th speech re-states the case, this time quite definitely pointing toward us. In this regard, we must realize the greater difficulty of revolt under modern conditions. Both inside Germany and in subject countries this is true. In a mechanized age, a country once disarmed will stay disarmed under proper surveillance. The squirrel rifle cannot expect successfully to rebel against the tank or airplane! I think this will to win can be far stronger in a people who are defending themselves in a righteous cause, who are fighting for ideals and principles in addition to more selfish aims. This perhaps accounts for the heroic stand of the English. As Knute Rockne put it, "The team that won't be beaten can't be beaten."

Material Factors

I spoke of National Defense being composed of two factors, psychological and material. The former has been discussed and should properly be placed first, but without the second, we would still be defenseless. War now involves the use of mechanical devices. This, in turn, involves the production of these implements and therefore encompasses the activities of every citizen. This is what is meant by "total defense". The production of tremendous "hitting power" operated by smaller number of fighting personnel seems to be the trend. The best offense is the best defense" is more and more becoming true. The "Maginot Line" and the "Liddell Hart" more passive defense theories have by practice proved inadequate. And for us, the airplane is the most important of all the "striking power" weapons that have been devised. Let us consider more carefully, however, just where we, in the United States, stand in regard to our fighting Services, and their relationship to each other.

U. S. Defense Problems

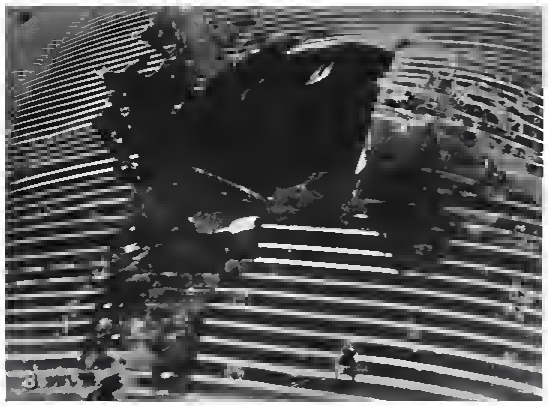
Aid to Britain

From what has been said before, I hope it is clear that our first and most immediate and most effective defense effort is and will continue to be to extend the maximum aid to Britain—to stop Germany. The rule-of-thumb airplane aid of one to Britain for one to our own Services should should be increased all possible, perhaps to one and one-half

(*Turn to page 130*)

BATTLE SCARS

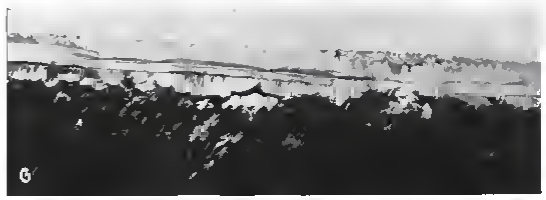
Modern all-metal airplanes show how they can take it under grueling conditions of European aerial warfare



By Paul H. Wilkinson
Consultant, Diesel Aviation

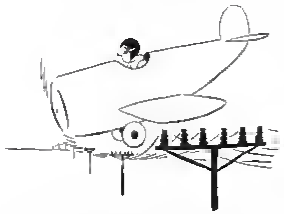
HOW much damage can a modern all-metal airplane withstand in aerial warfare and yet return safely to its base? This question has often been asked and the answer is of vital importance to the crews of military airplanes who are called upon to risk their lives in the air. The photographs herewith show the damage inflicted upon some of the airplanes of the German Luftwaffe during the European War. In all cases the airplanes returned to their base thanks to the inherent strength built into them and the skill of their pilots.

Thus we see that a modern military airplane can take a good deal of punishment provided its vital controls, its engine (or sufficient power units) and its gas tanks remain intact.



A Junkers Ju 87 dive bomber which had its fixed landing gear destroyed in combat.
B Wing of a Junkers Ju 52 transport damaged by an anti-aircraft shell which passed right through the all-metal structure without causing it to collapse.
C Hits on the tail unit of a Junkers Ju 87 dive bomber made by anti-aircraft guns.
D Outboard engine of Junkers Ju 52 transport damaged by anti-aircraft fire which destroyed one blade of the propeller and pulled the engine loose in its mounting. The airplane returned to its base on its other two engines.
E Rudder and part of fin shot away on a Junkers Ju 87 dive bomber.
F On another Junkers Ju 87 dive bomber the fin was shot away and yet the airplane returned safely to its base 75 miles away.
G Leading edge of wing of Junkers Ju 52 transport showing damage caused by a very severe hail storm encountered while transporting supplies. Other parts of the airplane including the wing flaps and the tail surfaces were damaged to a similar manner.

TO SUE OR NOT TO SUE

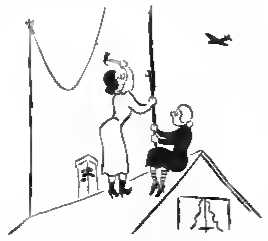


High-tension or telephones wires are legal and an airport manager cannot restrain their installation regardless of how dangerous they make flying

Part II

An airport owner or manager has many legal problems to face. Sometimes he is plaintiff — sometimes defendant. Here is a review of court cases pertaining to airport suits

By Solomon Rothfeld *Member of the New York Bar*



In the south west two irate women installed tall radio masts on their roof to inhibit air line flying from a nearby airport. The courts forced the removal of the masts.

An airport in Los Angeles was forced out of business because a residential area was built around it. This may be the fate of numerous other fields

While a farmer may prevent you from fly ing low over his house, he cannot prevent low flying during take-offs and landings over farm land adjoining an airport

IN Part I of this article, which appeared in November, Mr. Rothfeld reviewed a number of cases in which owners of property adjoining airports had erected obstructions to prevent landings and take-offs. The last case reviewed was one in which an owner had planted a row of 35-foot poplar trees, which the court forced him to cut down.

This case is clearly a practical application of the theory used in the Hinman case, which theory is a refinement of the theory adopted in the Thrasher case. If the court in the Tucker case recognized the Thrasher theory that a landowner is not only entitled to the upper airspace he actually uses but is entitled to that airspace within "the reasonable possibility of man's occupation and dominion" United Air Lines would never have obtained the type of injunction it finally obtained for who could say that 35 ft. of upper airspace was not within the reasonable possibility of man's occupation."

And applying this Tucker or Thrasher theory to our Mr. Harry Worcester Smith and his mythical 300-ft. silo, it seems that the silo's span of life would be quite short lived. For although the New England Aircraft Co. could not say that 300 ft. of the upper airspace was not actually occupied, it could claim that it was an obstruction to air traffic and wholly unnecessary for the proper enjoyment of Mr. Smith's property. In other words under this theory, which seems to be the latest enunciation by the courts on the subject, Mr. Smith and his 300-ft. silo could be forestalled and a great measure of relief given to commercial, private and municipal airports. So far so good, but let us shift about a bit and ride along with time.

As for Mr. Tucker, after the final decree was rendered by the higher court, he erected on the southern boundary of his property a 24-ft. pole with a red flag on top of it. The following day a news item appeared in the evening papers to the effect that because of an obstruction placed near the Iowa City airport the airline was compelled to cancel its scheduled stop.

It is needless to add that the Iowa City airport must have been quite small for a 24-ft. pole to interfere with its use and that a comparatively small increase in its size would have rendered Mr. Tucker's pole absolutely harmless. However, be that as it may, the case is unquestionably a very important decision and one which will probably play a major role as a precedent for future decisions.

Another case similar to the Tucker case, decided in 1937 by the Pennsylvania Appellate Court, seems also destined to play a major role as a precedent for future decisions in cases involving the same matter of dispute.

In 1929 a privately owned field named "Harrisburg Airport" commenced operations. Adjoining this airport a Mr. Bestecki owned a large parcel of land on which his own home was located. So annoyed did Mr. Bestecki become with the airport that in 1934 he erected a skeleton wood tower about 8 ft. square extending up 154 ft. in the air. The entire structure was invisible at night and during the day the guy wires supporting the structure were invisible. Under very mysterious and unexplainable circumstances this tower fell, but the undaunted Mr. Bestecki built another tower, this time being about 90 ft. high. Again under strange and unexplainable circumstances the 90-ft. tower one night mysteriously burned down. And again the undaunted Mr. Bestecki threatened to erect another tower. But this time the Harrisburg Airport was more than convinced that Mr. Bestecki meant what he said, so it immediately instituted an action to prevent Mr. Bestecki from erecting a third tower. During this litigation the airport was sold to the Commonwealth of Pennsylvania which took up the cudgels in behalf of the airport. At the trial the state proved that the former towers were erected in line with the radio beacon and light beacon maintained by the Federal and State Governments and directly in the path of the prevailing winds. It also proved that the towers were not in any way connected with the use of Mr. Bestecki's property or added to the full enjoyment thereof. It was also clearly shown that the tower would unquestionably endanger the lives and property of aeronauts and the air-traveling public.

The court reasoned along the same lines as in the Thrasher case. The court divided the air into two zones, the lower stratum and the upper stratum. As to the lower stratum the court said that a landowner has a dominant right of occupancy for purposes incident to his use and enjoyment of the surface.

As to the upper stratum, which a landowner may not reasonably expect to occupy, he has no right except to prevent the use of it by others to the extent of a reasonable interference with his complete enjoyment of the surface. Or to put it in other words a landowner can only prevent the use by others of the upper stratum of airspace if he can prove that such use by others constitutes a private nuisance to himself. The court then issued an injunction against Mr. Bestecki from erecting a third tower on his premises.

A careful examination of this theory reveals that although the court seems to adopt and use the same language as was used in the Thrasher case, for all practical purposes its conclusions more closely approximate the consequences of the Tucker Theory than the Thrasher Theory. But regardless of what theory is used the case would clearly seem to sound the death knell to Mr. Harry Worcester Smith and his 300 ft. silo. The Bestecki and Tucker cases seem to be the very solution required by the New England Aircraft Co. in its dilemma over Mr. Smith's hypothetical silo.

These two cases are the answer to our general problem and if followed by other states in the Union as precedents, may spell out the answer to all "spite fences" come what may.

But assuring and comforting as this may all seem, the ability of an airport to prevent the erection of such structures depends primarily on its ability to prove that the structure is in the general nature of a "spite fence."

Now let us suppose that Mr. Bestecki, who originally built the 154-ft. wooden tower, decides to erect a tower for sightseeing purposes or actually erects a six or eight-story apartment house with a fancy brick tower on the roof of the house. Could such structures be called "spite fences"? Could any court truthfully say that such structures had no connection with the full enjoyment by Mr. Bestecki of his own property? The Tucker and Bestecki theory allowed an owner to use so much of the upper airspace as he was in actual possession of and that had a direct connection with his full enjoyment of the surface of his property. Under the theory of these two cases Mr. Bestecki's hypothetical sightseeing tower or his apartment house could not be attacked as "spite fences" or as having no connection with the full enjoyment of the owner's right to use his property as he sees fit.

And it is this phase of the problem that makes the future of our airports a bit gloomy. Two recent decisions on this very problem decided in 1939 may in time to come receive the stamp of judicial approval and acquire the status of precedents. It is such decisions that can quickly deflate our optimism for a general over-all solution and it is such decisions that must be carefully watched.

Capital Airways, Inc., operated a small airport and flying school located adjacent to the city of Indianapolis. In fact, the airfield was so small that exceptionally low flying was necessary by visiting aircraft over adjacent property in landing and taking off. The Indianapolis Power & Light Co. built, across a highway adjoining plaintiff's property, a series of 90-ft. steel towers spaced 480 ft. apart and which towers supported wires carrying 132,000 volts of electricity. On the east of the airport the towers were about 100 to 250 ft. from the airport. Capital Airways, Inc., instituted suit to prevent the power and light company from maintaining the towers so close to the airport.

The court however was very unsympathetic and said:

> The establishment of an airport upon the appellant's land in no way affected or limited the right of adjacent landowners to use their land in any manner and for any purpose for which they might have used it before. Had the appellee (Indianapolis Power & Light Co.) chosen to erect flagpoles, factory chimneys or tall buildings across the whole of its land, and several times as high as its power line it was within its rights notwithstanding it might have entirely prevented the landing of airplanes at appellant's (Capital Airways, Inc.) airport.

And this very briefly is the story of how Capital Airways was put out of business near the city of Indianapolis.

It is true that the airport in this case was a small one. But the case merely shows what a court's reaction may be when an airport attempts to limit a landowner from making proper use of his own property. Now let us turn our attention to another case which is equally disconcerting and generally adds to our difficulties in finding a proper solution to our general problem.

In 1924 the Dycer Flying Service built an airport in Los Angeles and operated it successfully for fifteen years. In fact at such a desirable spot was this airfield that within those fifteen years of operation a residential section had sprung up, and the general area was zoned as a strictly residential zone. Then out of the clear California sky, the state instituted an action against the Dycer Flying Service for the purpose of preventing the operation of the airport as such, on the ground that after fifteen years of service it had become a general and public nuisance. The usual complaint was made, low flying, dust, noise and crowds. An additional grievance was mentioned, that occasionally oil dropped from aircraft overhead.

The court immediately ruled out any claim by the airport of priority in use, on the possible ground that the airfield was first constructed and operated before a residential section sprung up. The court then defined a public nuisance and said that it must be such that it affects at the same time an entire community or neighborhood or any considerable number of people, although the annoyance or damage upon individuals may be unequal.

The court then cited for its authority the Harry Worcester Smith case, the Swetland case, the Thrasher case, and Gay vs. Taylor and then started to wield its axe. It ruled that the Dycer Flying Service must cease raising dust, cease causing congestion by the attraction of crowds, stop the noise and dropping of oil, and lastly cease flying regardless of whether it be on the take-off or in landing, lower than 500 ft. over adjoining property.

Although some consolation may be found in the fact that the field in this case was quite small and not particularly well constructed so as to prevent spreading of dust, still the possibilities that may result from this case if it receives judicial approval is appalling. For under this decision what airport, municipal, commercial or private, can ever be assured of its continued existence when factors beyond its control can eventually become strong enough to strike at its very foundations, and strike at them successfully?

With communities constantly growing up and usually located in the proximity of commercial and industrial centers, there is hardly a single airport in existence today that will not at some time in the future become a potential public nuisance to the surrounding community.

It is true that through technical advances dropping of oil, making of noise,

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Pressurized Cabin Control

By H. E. W. Tinker and H. S. Hubbard

Airesearch Mfg. Co.

THE insatiable desire of man to fly to increasingly higher altitudes is not alone dictated by his desire to achieve dominance over nature's barriers. There is also an economic factor involved since flight at higher altitudes will permit greater speeds, and also from a military standpoint it removes the aircraft from the range of ground observation and gun fire. However, this desire for higher ceilings cannot be achieved without transgressing the physiological limitations imposed on man by nature. We have all experienced difficulty in catching our breath after a climb up a mountain but have also noticed that as we stay at this higher elevation for a period of time we eventually become acclimatized to the rarer atmospheric conditions. If this process of elevation were made by slow and easy stages, it would be possible to eventually accustom the human body to the lower pressures experienced on extremely high mountains. But in the flight of aircraft we are faced with the problem of rapid ascent and descent with an intermediate period at which the high altitude may be maintained throughout the range of flight. In order to do this, we must in some way provide an adequate supply of oxygen under pressure and this may be accomplished in the most comfortable and practical method from all points of view by means of the pressurized cabin.

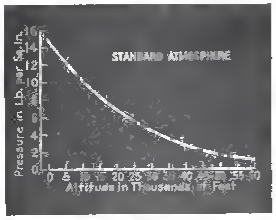
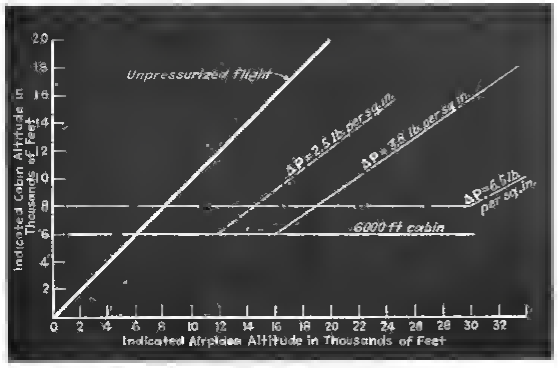


Fig. 1 Pressure vs. Altitude in Standard Atmosphere (left).

Fig. 2 Cabin plane altitude Curves.



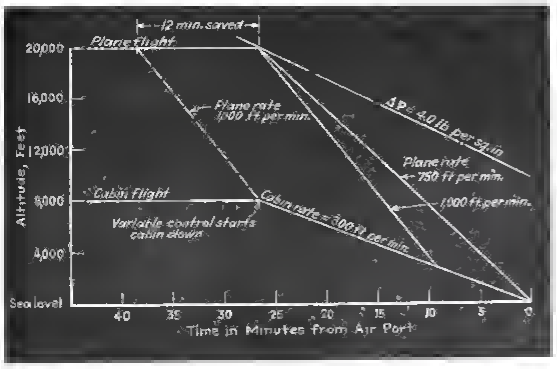


Fig. 3 Chart Showing Example of time saved using variable absolute pressure control over present control.

The pressurized cabin has passed the novelty stage and become an actuality as may be evidenced by its introduction into airline service on the Boeing Stratoliners. To many the pressure cabin control still contains an element of mystery which it is hoped may be somewhat clarified in this article by presenting a description of the operation of the Airesearch Control which is a modification of that used on the Stratoliners and for which United States Patent No. 2208554 has been issued.

Before delving into the advantages and limitations of the pressure cabin it would be well to review briefly the physiological effects that make cabin pressurizing desirable from the standpoint of the individual who must operate or fly with aircraft on civil or mili-

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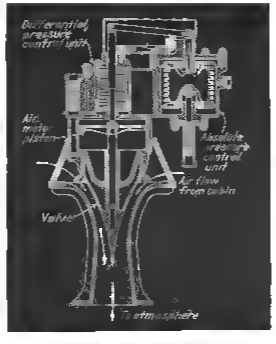
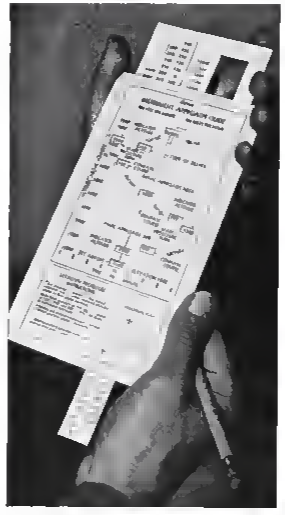


Control device for pressurized cabins



STANDARDIZED Let-down Procedure

The author has developed an instrument approach guide which should interest all pilots who fly on instruments.

By Allan A. Barrie *Captain Western Air Express*

Above is a close-up view of the Barrie Instrument Approach Guide. There are ten slots to the face of the guide, each indicated by a small arrow. Airport elevation is set in lower center cutout and immediately five other indicated altitudes assume correct positions. Two other sliding panels give pertinent information in four other spaces. Right: Captain Barrie holding an Approach Guide.

MUCH attention has been given to instrument flight procedures and methods of orientation when flying by instrument on a radio beam course but there has been quite a difference of opinion as to how to approach the terminal field after crossing the radio cone of silence. The writer has worked out a practicable standardized approach method for let-down procedure which is applicable to airline, military, and private flying operations. The method is so simple that it has been possible to incorporate it in a pocket Instrument Approach Guide for use of the pilot in letting down to the field after crossing the cone of silence.

The Barrie Instrument Approach Guide is based on the experience gained in teaching instrument flying in the California National Guard and to the pilots of Western Air Express. It is based on the knowledge that the method of flying down a radio range is fairly simple. Using the A and N code signals to arrive at the cone of silence is an easy technique to learn and is easy to remember. However, upon arriving over the cone of silence the various methods and procedures for descending to the field have been somewhat involved and confusing. The Barrie Approach Guide seeks to simplify let-down procedure by a standard method suitable to all planes and radio ranges. It has been used in several Link Trainer courses by TWA, Mid Continent, and Continental Airlines. It is also used by pilots of Western Air Express in instrument descents and has been adopted by many pilots of United Air Lines.

Basic assumption of the Barrie Approach System is that the plane is brought over the cone of silence at an altitude 9,500 ft. greater than that of the airport. From this point the approach is made along the safest legs of the range by means of following a symmetrical flight path out and back with standard procedure turns at each end of a zig-zag descending flight path at 120 m.p.h. and 500 ft. per minute rate of descent. However, the Barrie Instrument Approach Guide is so arranged that a wide choice of altitudes for the initial approach is practicable. Although the basic procedure calls for an approach time of 16 min., this may be cut to 8 min., or even to 4 min., depending upon circumstances, nature of the terrain, etc. In any case the Barrie pocket approach guide makes it easy to follow the desired procedure precisely.

Recommended approach procedure is illustrated graphically by means of a chart on the face of the Barrie Approach Guide. This chart is symmetrical with the cone of silence as the zero point at the center of the horizontal scale. The chart reads horizontally from zero to 4 min. both left and right of the cone of silence, while the vertical scale is indicated by increments of 1000 ft. altitude above the airport. Let-down procedure instructions are printed at the base of the chart, together with an illustrated procedure turn requiring 2 min. for a 180 deg. turn.

Altitude of the home airport is set by means of a sliding scale, while two scales are used to set the compass course out and back along the selected leg of the radio range. Altitude of the field can be taken from the map. Once this is set the indicated approach altitude and the check altitudes for starting each procedure turn, and for crossing the cone of silence at the half-way point in the descent, and on the final approach, are all shown in appropriate windows on the chart. The slide will accommodate airports from sea level to 6,500 ft. elevation, giving a top initial approach altitude of 16,000 ft. If it is practicable to come over the cone of silence at only 5,000 ft. above the ground then only the final approach area need be used and airport elevations up to 11,000 ft. altitude can be set on the guide.

As an example of the use of this method, in conjunction with the Barrie guide let us assume an airport elevation of 1,000 ft. When this elevation is

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Production At Noorduyn

With the swiftly accelerating production of the Canadian aircraft industry playing an ever increasing part in Empire defense, these views of the factory facilities and model trainer produced at one of Canada's outstanding plants reveal the impressive development of the industry north of the border.

Looking aft in the cabin (Top) of the R.C.A.F. type Norseman showing accommodations for wireless equipment and students.

(Above) With monthly volume of production roughly twelve times that of a year ago, the Noorduyn Norseman is rapidly becoming an important factor in Royal Canadian Air Force training.

Below: Looking into the main building of the Noorduyn plant. Norseman and Harvard airplanes in primary assembly on right. Final assembly and flight test departments are located in another building.

Where blows are struck in defense of the Empire. Three-ton and one-ton drop hammers. The same building houses the die foundry, power hammers and hydraulic press.

Niagara stamping presses and Cincinnati and Verson press brakes used in production. The Cincinnati press brake in the background forms spar flanges twelve feet in length.

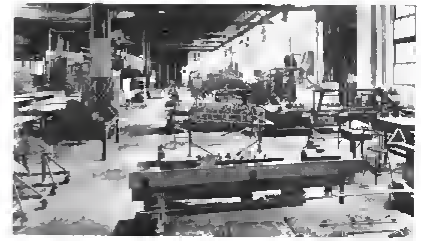
Noorduyn Aviation employs important and modern processes. Right, the heat treat furnace quenching chamber and electric spot welder. Tank and riveting jigs in the background.

Designed and made by the Noorduyn staff this installation of vapor degreasing, anodizing, zincing and cadmium plating tanks has been described as one of the finest in North America.

The machine shop a completely empty space seven months ago, is now running on two shifts on Norseman and Harvard parts. In that time Noorduyn's occupied floor space has been quadrupled.

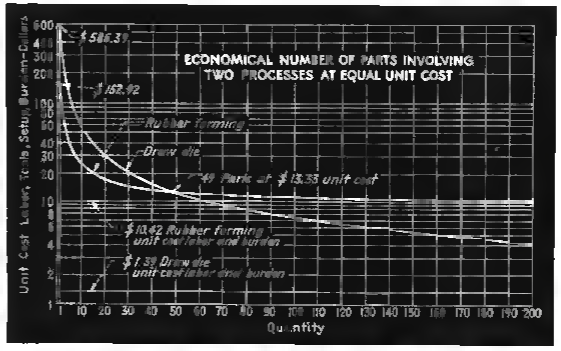
The west aisle showing detail assembly bench lifting and welding. With new buildings in operation, a production increase of 700 per cent will have been made in less than twelve months.

Harvard surface riveting jigs in the east aisle of the factory. This plant will soon be used entirely for component manufacture as all assembly operations will be moved to new buildings.

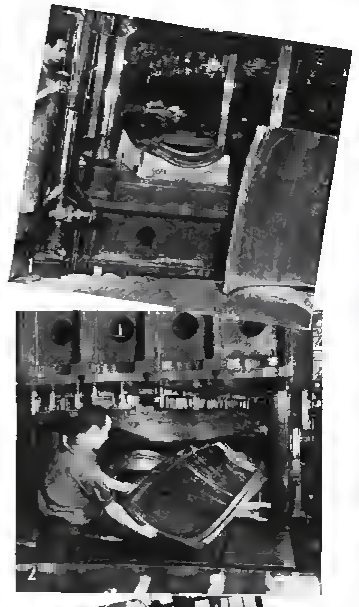


Welded structures shop showing Norseman and Harvard fuselages in stages of construction. Superintendent's office on mezzanine overlooks entire main plant floor 500 ft. long by 134 ft. wide.

Curtiss-Wright's roller conveyor system for landing gears.



A comparison of methods in making an engine cowl. Although the tool cost for the draw die is almost four times as great as for rubber forming, the two methods equalize at a point as low as forty-nine parts.



(1) An inefficient cowl-forming way. (2) the new draw die method; (3) trimming by judgment used, (4) using the router form

Applying Automotive Methods to Aircraft Production

With the airplane a decisive factor in world issues, attention is directed to the experience and facilities of the world's outstanding mass production enterprise, the American automobile industry

By Dan R. Barlin *Dir. of Military Engineering Curtiss Aeroplane Division*

and

Peter F. Rossmann *Research and Development Engr., Curtiss Wright Corp*

THE international situation has demonstrated that the effectiveness of the airplane is a decisive factor in the outcome of the issues at stake. This potent weapon has directed attention to the urgency for quantity production of aircraft essential to National Defense.

With the need for increased production quantities it is natural that there should be serious interest in the application of mass production technique in the manufacture of aircraft. Consequently, the aircraft industry is urged to utilize the experience and facilities of the world's most outstanding mass production enterprise, the American Automobile Industry. Although no single business can lay claim to mass production as being its own development, the automobile industry has probably contributed the most through its bold and realistic approach.

It is the purpose of this paper to indicate what can be accomplished in planning projects and processes, involving Design, Tool, Production, and Process Engineering, and to outline the various elements so necessary in the achievement of the high industrial efficiency which has become synonymous with mass production.

In that the term mass production has become decapitalized the true definitions are somewhat obscured and since the subject is too comprehensive to permit more than limited treatment, it is the intention, through this resume and accompanying illustrations, to define briefly the requisites to mass production and its expectations in the manufacture of aircraft.

To the casual observer the question arises as to why the methods and practices of the automotive industry are not more extensively utilized in the manufacture of aircraft. More than superficial observation will reveal that what appears to be reluctance on the part of the aircraft industry to accept automobile production standards is due primarily to the numerical and other differences in what constitutes quantity or mass production and the influence of contingent conditions peculiar to each field. Five hundred cars per day under normal circumstances would not represent unusually high production, whereas up to recently ten airplanes of one type per day would be outstanding. The situation is further complicated by the imperative compliance to rigid weight, performance, reliability, and strength specifications in aircraft manufacture. An empty gas tank or a broken gas line in an automobile is not a serious hazard, it's an inconvenience, while in an airplane a similar failure usually represents an emergency.

Special and single purpose machine tooling and extensive conveyor systems are economically essential in the manufacture of 100,000 cars wherein certain details of the cost of 1/100 of a cent becomes important. In aircraft construction the application of such refinements obviously cannot be as extensive. It is not to be construed, however, that the aircraft industry is barren of opportunities to apply advanced production methods. Careful analysis supports the conclusion that much can be gained through the utilization of automobile methods and practices when combined with a liberal application of common sense.

Before proceeding further, it will be helpful to clarify some fundamental principles inherent in what is commonly known as mass production. The term is somewhat misleading, the general belief being that it involves only the manufacture of a large number of identical parts usually by means of special machine tools. Quantity alone does not make mass production, however; mass demand is a reciprocal factor.[1] Therefore, it is necessary to differentiate between large quantity and mass production. A change in the production demand from 100 to 1 000 parts with certain time limitations, requires more than merely moving the decimal point on a Shop Order. It may necessitate redesign or retooling of the part.

Mass production results in uniformity, and this consequence is evident in the production of many things that are a part of everyone's daily activity, wearing apparel, cigarettes, even in the canned and packaged food we consume. This accurate duplication of results which changed luxuries into necessities can best be illustrated in that although a single craftsman can produce an object of superior quality, it is unlikely, except under the most propitious circumstances, that the same craftsman can duplicate the original results exactly; nor is it reasonable to expect that artisans of equal skill, using average tools, can produce identical results.

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Formula computing comparative cowl production costs.

By Harold P. Moon

General Manager
Summit Aeronautical Corp
Bendix New Jersey

Development of

A Plastic Molded Airplane

INCREASING demand for light aircraft attests to their eligibility for volume production under advanced procedures and methods. Economic advantages through volume production can only be achieved if materials are processed with a minimum of hand labor throughout all phases of fabrication and assembly. Commonly used torch welded tubular framework is difficult to adapt to mass production since assembly cost varies only slightly regardless of volume. Moreover the welded tube fuselage does not efficiently lend itself to the elliptical streamline shape of a fuselage having low overall drag. Duralumin structures are also extremely expensive due not only to high material cost, but also to elaborate heavy machinery necessary to press, extrude, and otherwise prepare pieces for final assembly. Molded plastic-bonded structures are, it is believed, one solution to the attainment of high aerodynamic efficiency at low cost.

The art of molding aircraft body structures is not new. The Lockheed "Vega" designed 14 years ago, had a molded casein-glued fuselage. Hydraulically bag-pressed over a concrete mold, this plane probably grandfathered present day molded aircraft. In England and Germany, prompted by efforts in war production, the art of molding plywood has made substantial progress. (See AVIATION, July, 1940)

In talking with persons interested in, or employed by the aircraft industry one sees confusion in understanding what a plastic is and how it is used. Plastics are divided into two groups—natural and synthetic. Nature, for example, ... the form of ... rubber, ... and waxes. However certain natural plastics, being of an organic nature, support bacteriological life and fungus growth—thus in time lose their physical identity.

Synthetic plastics can be applied in some part of almost every man-made structure and the chemical developments in the creation and control of synthetic plastics is fast and furious. The synthetics are divided into two categories—(1) thermosetting plastic and (2) thermoplastic. The former are heat hardening, that is, when the temperature is raised and pressure applied simultaneously a chemical change known as polymerization takes place. Polymerization is best illustrated by the manner in which concrete is poured and then sets. Once this chemical change has occurred the plastic will never alter its structure unless acted upon by something to destroy it throughout the length of its stable life.

In the group of thermosetting plastics we find the phenol formaldehydes, the urea formaldehydes and the furfural phenol resins. Plastic ash trays, automobile steering wheels and other molded and cast gadgets, electrical insulating parts, etc., all consist of plastics in this group. Thermosetting plastics are commercially known as "Bakelite, Formica, etc." Minimum temperature of 300° F and pressures between 2,000 and 5,000 psi are required to polymerize thermosetting plastics.

The second, or thermoplastic types are heat softening, that is, if heat is applied the substance becomes soft and "tacky." Again cooled it will harden. Thermoplastics can be molded any number of times always returning to a hard set. Included in this group are cellulose acetate (cellophane), cellulose nitrate (celluloid), polystyrene, methyl methacrylate (Lucite and Plexiglas).

A plastic in itself lacks proper tensile strength. It is hard and therefore will absorb high shear and impact loads. As an adhesive it tenaciously grasps when used as a bond. Hence plastic is suitable in a stressed or loaded structure only when a filler agent such as cloth or wood is used and thereby becomes merely a bonding agent supporting fibres of complex structures and transmitting a load from one to another. Because of its favorable weight-strength ratio wood is a practical filler material for aircraft structures, therefore veneers can be easily used.

A comparison of the properties of

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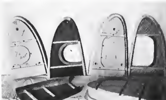
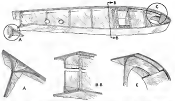
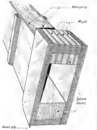
A top view at the point where the fin joins the fuselage, with the fin removed illustrating where the various loads are distributed into the fuselage



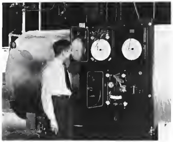
Left. An example of the wooden molds used in fabrication. The die at the left holds the parts in place which form the rib second from the left. The die second from the right holds the parts for the rib at the right end. The pieces in front similarly formed with the groove in the die holding the wooden rib braces over which the veneer is laid and molded as one piece.



Below. The ribs of the Summit HM-5 although molded in one operation are made up of many similar pieces. The enlarged drawing "A" where a corner of the rib has been removed illustrates the joining together of 4 pieces of veneer and 3 bracing blocks. Section "B-B" enlarged shows how the upper and lower surfaces of the wing are joined as an intrical part of the ribs and section "C" illustrates how the seemingly complicated joining of the nose of the rib is done rather easily. All of these parts are joined together in one operation.



A cross section of the main spars showing how the various sections of plywood are molded together.



A view of the pressure chamber in which the molded parts are formed showing the automatic temperature and pressure recording apparatus. This equipment is installed at the Bristol Aircraft Corp, Bristol, Va.

X-RAY
Finds Flaws in Aircraft Parts

Defective material is rejected through new scientific method

By Tom Triplett
Triplett & Barton, Inc.

BEHIND a door marked "X-Ray Laboratories", a group of young scientists at the Lockheed Aircraft Corporation's factory in Burbank, Calif., are X-raying 'finger printing", crushing and tearing apart, and fatigue-testing thousands of metal parts daily. Our job is to find flaws, if any, in the castings and forgings sent from foundries in all parts of the United States, and in welded sections produced locally.

With the future of our national defense dependent upon the skill and speed with which the aircraft builders can turn out planes, our work takes on special significance at this time, particularly as we are eliminating delays formerly occasioned by the handling of faulty parts on the production line. Under this system of inspection and testing only sound parts are machined.

Five years ago when Victor Barton and I opened our independent research laboratories, which are housed in the Lockheed plant, the use of X-ray and metallurgical diagnosis was new to the aircraft industry. At first, X-ray examination of class 1 and stress parts was limited to 10 per cent of the total used. During those days the inspectors in the machine shops were expected to detect flaws in the metal parts handled. But even the sharp eyes of the inspectors were not keen enough to catch all the defects occasioned by the faulty mixing and pouring of the alloys at the foundries. Experience soon proved that 100 per cent X-raying of class 1 and stress parts actually saved time, because it assured that no time would be wasted in handling parts on the production line that were unsafe to put in a plane.

Regarding the rejection of faulty parts, on occasion it has been necessary to turn back a major portion of a foundry order because of flaws revealed by the penetrating rays of the X-ray machine. Since the modern plane is made up of thousands of separate parts, in some of the larger ones the number runs as high as 100,000, it is important that any that might cause structural failure be eliminated.

During the first stages of the X-ray and metallurgical research work, the radiographing of 100 parts a day was considered an achievement. The average was 30 to 40. By way of contrast, we recently installed a new, fully automatic X-ray machine that will photograph 5,000 average parts per day. It is a compact unit, with all essential parts housed in a cabinet, ten feet high and four feet square. Due to the use of 1500 pounds of lead lining, the operator can stand beside the machine without being exposed to dangerous X-rays.

It represents four years of intensive study and comes into service at a time when increased output is most needed by the industry. We estimate that ten of the new X-ray machines can handle the X-raying of all the stress parts that would be used in 50,000 planes a year. Additional machines are to be ordered to replace the three older X-ray units now operated by our laboratories. The older units have about 30 per cent of the capacity of the new machine, which is designed for continuous conveyor belt feeding and can be hooked up in a battery with three or four others. A conveyor table arrangement, however, is being used on the first machine.

The new machine contains many improvements that the X-ray specialist will appreciate. The fact that the operator can work alongside of the cabinet eliminates the time previously required to wheel parts in and out of the lead-lined X-ray chamber in which the X-ray equipment was previously housed in the interest of safety. The X-ray tube and transformer are encased in the upper portion of the cabinet which is raised and lowered by an automatically controlled electric hit. In order to eliminate high voltage cables, the X-ray tube is plugged directly into the transformer. This arrangement makes it possible to replace the tube in one minute in case it should burn out.

The machine's robot control is a small, compact separate unit. In case of break down of one control, a switch to a new one can be made in a few minutes. The operator can select the exposure he wishes to use, and the speed at which he wishes to feed the machine, set the control accordingly and concentrate his attention on getting parts on and off the conveyor table.

The machine will handle the largest airplane castings made. Special gates on either side of the cabinet make it possible to radiograph fabricated pieces up to 30 feet long and two feet in diameter.

Every part sent to the X-ray laboratory is first die-numbered for future identification. A record is kept of each part and the plane on which it is used. Portable rack is at left.

This is the latest type of X-ray machine, developed by Triplett and Barton. It will photograph 5,000 parts a day and can handle largest structural parts being used. Below: the X-ray tube and transformer are housed in upper portion of the cabinet. The tube is plugged directly into the transformer.

The growth in the use of X-ray as an inspection tool is indicated by our records which show that in the first four years of operation we X-rayed 500,000 parts. During 1939 we X-rayed more than a half-million parts, and this year expect to exceed one million. We are today the largest single users of film in the United States, and possibly the world. Our rate of exposure is about a gross of 14x17-inch film per minute.

The tremendous increase in the capacity of X-ray equipment is attributed to many factors: improved machines and improved method of handling parts in the X-ray department; development of a fool-proof procedure and building up of a personnel capable of functioning on a 24-hour basis; better films, which have been changed from a No. 1 to a No. 10 rating in the space of three years; better screens, that have made film action 20 to 40 times faster, and developers that retain rather than lose their effectiveness with use.

All parts brought into the laboratory for testing are immediately identified with a number. A work order is then issued carrying general information concerning the parts, where and how they are to be used, and their identification numbers. Each part is die-numbered to correspond

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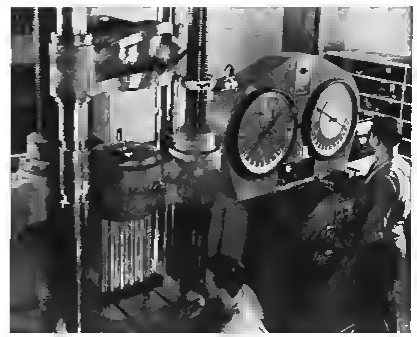


At regular intervals, parts ok'd by X-ray are double checked in this compression machine, which exerts up to 300,000 lb. sq. ft.

A technician studies each X-ray plate. This plate shows 41 parts.

Warplane Factories in Germany

Diesel engine production has long been an important factor in the German Air Force program

Part III

By Paul H. Wilkinson

Consultant Diesel Aviation

A DESCRIPTION of the warplane factories in Germany would be incomplete without reference to the Junkers diesel factory in which thousands of the engines used by the Luftwaffe and Deutsche Lufthansa have been produced. This large ultra-modern factory located near the headquarters of the firm at Dessau is unique in that it is the only factory in the world in which diesel aircraft engines have been produced on a large scale. Like other factories in Germany it is a self-contained unit spread over a considerable expanse of ground with its own anti-aircraft defences and air raid shelters deep in the ground.

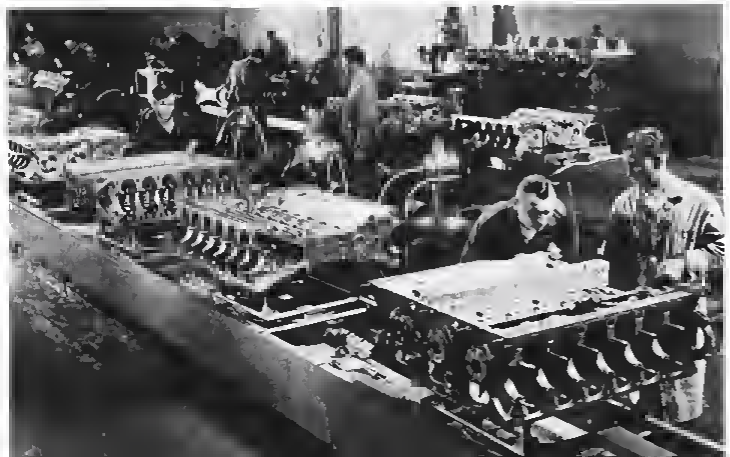
After a tour of the numerous one-story buildings at the diesel factory it is obvious that the application of mass production methods to the manufacture of diesel aircraft engines is just as practical as it is for gasoline aircraft engines. Tooling up for large series production does not present difficulties even in the case of an unusual type of engine such as the Jumo 205 diesel. Special machines are essential for the economical processing of certain of the parts but these machines can be designed so that they can be used with different tooling for production of larger or smaller engines of the same basic type.

The machining of the one-piece Silumin alloy cylinder block of the Jumo 205, with its intricately-cored water passages, is interesting to watch. The facing of the top and bottom and two ends of the casting is relatively simple. For the machining of the six long parallel bores for the cylinder liners a special horizontal boring machine is used. On this machine the cylinder block is mounted horizontally on a table which moves up to three long boring bars which bore and face three of the holes simultaneously. The cylinder block then is moved sideways on the table and the same operation is repeated for the remaining three bores.

For the machining of the recesses and caps for the seven crankshaft bearings at the top and bottom of the cylinder block a similar type of boring machine is used. The block is mounted horizontally on a table as before and two boring bars process the two sets of recesses and caps simultaneously. The thirteen bearings in the long injection pump camshaft housings are broached on a special machine which performs this operation in approximately 1 min.

The cylinder liners require considerable machining from the time they arrive at the factory in the form of hollow steel forgings to the time they are ready for assembly in the engine. The liners are bored to close limits on a twin-spindle horizontal boring machine and then are ground and honed on a special twin-spindle grinder. As the liners are unusually long these operations have to be performed on a machine in which the liner can be chucked centrally and processed at both ends simultaneously to prevent distortion. Other intricate operations on the liners include milling grooves around the outside of their mid sections to increase the cooling area, milling a number of large tangential slots for the exhaust ports and drilling a large number of small tangential holes for the inlet ports.

Most of the other parts of the engine, with the exception of the hydraulic vibration damper and the fuel injection pumps and injectors approximate the parts found in a water-cooled or liquid-cooled gasoline aircraft engine. The relatively small six-throw crankshafts are similar as are the spur gears used to provide a reduction drive for the propeller shaft. The ground blower on the Jumo 205 contains a gear-driven double-entry impeller for supercharging and this unit is similar in construction to a supercharger.



Start of one of the flow lines in the Junkers diesel factory showing the cylinder blocks after they leave the machine shop.

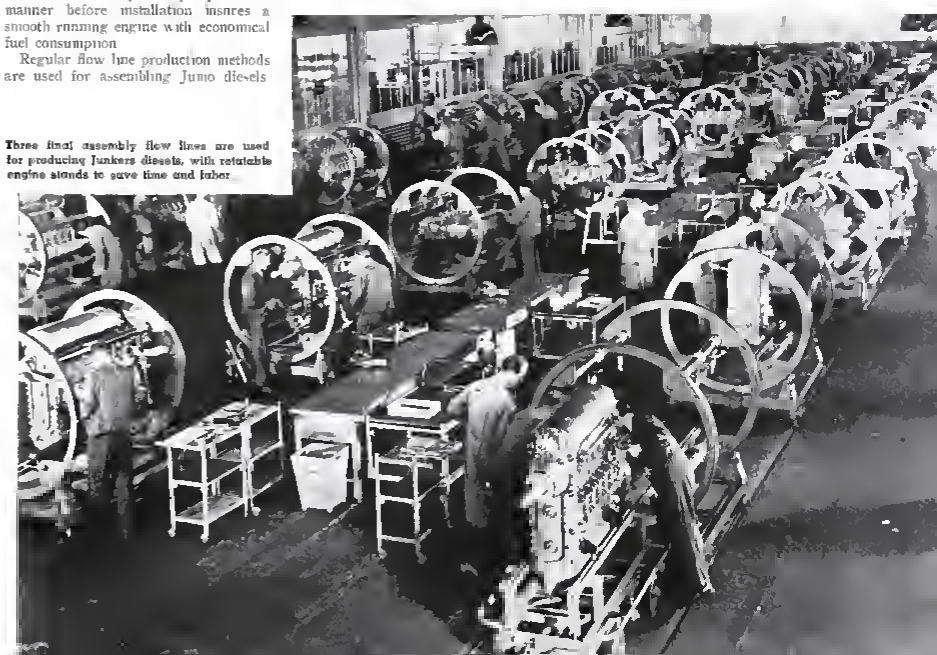
Special methods are used for the inspection of the various parts before they are released for assembly. The fire-rings used on the pistons are tested at four points on their circumference to check their external diameter, roundness and concicity. The large bores of the cylinder liners and the minute bores of the fuel injection pumps are inspected with Zeiss optical devices to check the quality of their surfaces. X-rays are used to check the location of the bored holes in small steel rods which then constitute high-pressure tubing leads for connecting the fuel injection pumps to the injectors on the engine.

The calibrating and matching of the fuel injection pumps is particularly interesting. After the pumps have been assembled and tested individually they are mounted in sets of six on their camshaft covers and two sets are attached to a special machine on which they are caused to function as on an actual engine. This testing machine has dummy combustion chambers into which the injectors are screwed and connected to the pumps by means of high-pressure tubing. The pump camshafts are driven at predetermined speeds by an electric motor and the fuel injected into each combustion chamber is caught in glass jars. After a definite interval of time the machine is stopped and the jars and their contents are weighed to determine whether all of the pumps have been injecting the same quantity of fuel. Matching the two sets of fuel injection pumps in this manner before installation insures a smooth running engine with economical fuel consumption.

Regular flow line production methods are used for assembling Jumo diesels. The final assembly of the engines is carried out in three flow lines. The cylinder block castings are secured in rotatable engine stands so that the various parts can be installed and attached with the minimum amount of time and labor. The cylinder liners are laid out in sets of six on wheeled tables alongside the engine stands and after the liners have been installed the twelve piston and connecting rod assemblies are brought up on another wheeled table followed by the two crankshafts and their spur gears. Judging from the length of the final assembly flow lines and the speed with which the engine stands were moved up as finished engines were removed from the lines, it appeared that from four to six diesels could be produced during one work shift—that is to say, from 100 to 150 engines a month. With three shifts working production probably could be increased to 400 engines a month.

With regard to the human element at the Junkers diesel factory one could not help being impressed by the excellent working conditions which prevailed. Strikes and so-called "collective bargaining" were "verboten" and as there were no labor difficulties with which to contend, everything was humming like a top. In the cafeterias for the employees the food was plain and wholesome and there was plenty of it. In the grounds were a large swimming pool, a gymnasium, and a clubhouse with a well-stocked aeronautical library. The cloak roooms and lavatories in the factory buildings were models of cleanliness. At this factory, as at other warplane factories in Germany, many of the employees came to work on bicycles which were stacked vertically on their rear wheels in long bicycle sheds. In 1939 the "people's car" was not in evidence as other uses were being found for raw materials and gasoline.

Machining the exhaust ports in the long steel cylinder liners is one of the most intricate operations and is performed with great care to insure close tolerances.



Three final assembly flow lines are used for producing Junkers diesels, with rotatable engine stands to save time and labor.

Machine Scheduling

PART III

By C. W. S. Parsons

M.E., Consultant

Rapidly mounting demands on aircraft parts makers call for closer control of machine loading. In this third of a series of three articles Mr. Parsons deals with principles and methods involved in scheduling and controlling the work passing through the shop.

IN one brief year the volume of work of the Southern California job shops handling the outside production of parts for the aircraft industry has expanded many fold and is likely to increase still more in 1941.

A year ago, in addition to assuming direct operating responsibility, shop supervision to a great extent performed the functions of production control. Shop foremen did much of the estimating, checked over incoming orders, hunted up tooling and material, planned the work and routed it through the shop. They also answered the calls of aircraft factory follow-up men. But now the pressure of work makes this almost impossible.

Today every shop has many more men whose work must be supervised, many new ones requiring special attention and training. In order not to break the back of shop supervision it is necessary to relieve it of all responsibility not connected with directing the work within the shop itself. It is there we must look to mechanics and master mechanics to exercise the skill and experience needed for getting out satisfactory airplane parts.

By the same token it is evident that orders should now go into the shop ready to work, with tooling and material available, blueprints in order, and definite times assigned for beginning the various operations so as to assure the meeting of promised deliveries. In other words the shop needs the cooperative service of a production planning unit which shall take on the responsibility for routing jobs through the shop, scheduling them on the machines, but first running down the shortages and deficiencies and otherwise taking on the follow-up of loose ends.

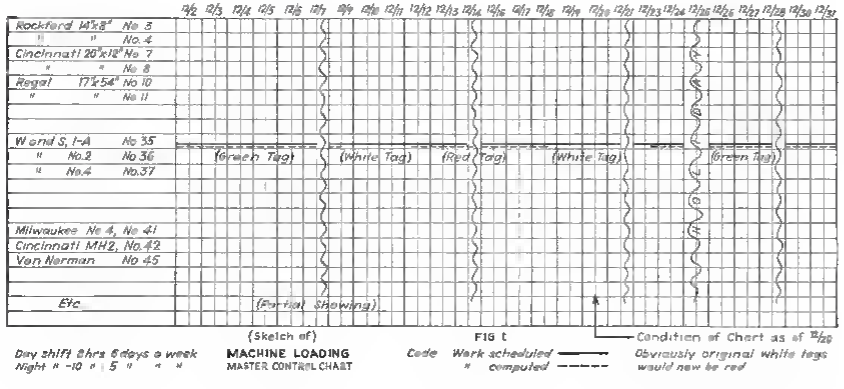
There are certain things which must be taken into account when setting up the planning function for jobs making airplane parts. It must be remembered that the aircraft industry is different from other businesses when it comes to establishing the functional principle in shop operation. General formulas do not necessarily apply, and it may be that calling in an engineer familiar with conditions as they exist will be helpful, as well as time saving and money saving.

The wide variety of work and the relatively small size of orders indicate the need for simplicity and economy of method of planning. The extreme pressure exerted on the shops to get out "hot orders" and "reworks" at a moment's notice requires that great flexibility be built into any machine schedule as an integral part of it.

At the present time the parts shops estimators usually do not analyze in detail the routing of the work on the machines. In preparing estimates on work requiring special tooling, or on operations not readily assignable to universal type machine tools, they largely depend upon shop supervision to tell them how the jobs will be run. This brings in a critical factor which must be taken care of.

If shop supervision is to be relieved of the routing and scheduling, it follows that adequate routing and scheduling must be provided. Few men on the outside are qualified to determine machine rontings and operation times, and few men can be spared from the shop itself. Yet someone must be trained for this work, or the present estimator must expand his duties to include making accurate, detailed breakdowns of operation times for work to be done on specific machines. Hence there may be, and most likely will be, need for creating the new planning responsibility a step at a time. In the interim the shop may have to continue to advise the estimator as a means of freeing itself later for concentration on operations.

In the larger shops some use is being made of time-study men to check and analyze jobs going through the shops. This serves the purpose of disclosing opportunities for bettering present methods and in connection with scheduling and building up data from which to construct new estimates. But in the average job shop the estimated times of operations must remain dependent upon the estimator's experience and judgment as applied during a study of the blueprint. The method of scheduling must embrace whatever means are provided to compensate for differences between the time it is estimated a job will take and the actual time it does take. But having thus dwelt on some of the difficulties, let us now consider some of the basic principles, and how to make use of them.



(Sketch of)

FIG 1

MACHINE LOADING
MASTER CONTROL CHART

Day shift 8 hrs 6 days a week
Night " 10 " 5 " " "

Code: Work scheduled ——— ; " completed - - - - -

Condition of Chart as of 12/28

Obviously original white tags would now be red

Day shift - 8 hrs - 6 days a week
Night " 10 " - 5 " " "

Machine I-A W and S No 35

No of Parts	Date Due	Part Number	Purchase Order No.	Est Hrs	M D	N	T D	N	W D	N	T D	N	F D	N	S D	N	M D	N	T D	N	W D	N	T D	N	F D	N	S D	N	M D	N	T D	N	W D	N	T D	N	F D	N	S D	N
					12/2		12/3		12/4		12/5		12/6		12/7		12/8		12/9		12/10		12/11		12/12		12/13		12/14		12/15		12/16		12/17		12/18		12/19		12/20		12/21	
1000	12/14	1053421	4867	100															2 (Green Tag)																					
60	12/5	324781	10628	6															5 (Red Tag)																					
250	12/30	386972	12312	50																			4 (White Tag)																	
180	12/10	1063721	5432	90																			4								6									
588	12/20	432876	10520	60																											4									
2500	12/15	3061728	6372	184	6 (White Tag)																																				

(Sketch of)

FIG 11

INDIVIDUAL
MACHINE CHART

Order listed as received
Code: Work scheduled ———
" completed - - - - -

Condition of Chart as of 12/28

Red tag orders hot or past due
Green tag " due to start this week
White tag " futures

Obviously original white tags would now be red

The first principle is that if the orders flow into the shop, ready to run, they go on through the shop with very little trouble. The main grief comes from new orders on which new tooling must be proven. Beyond that, it is the percentage of orders having something wrong with tooling, material, or specifications which now stirs up most of the trouble and ever knocks the orders ready to run into the past-due column. Hence we will schedule only orders ready to run, and the minute orders arrive short of anything needed turn the pressure on the buyer to get the discrepancy corrected. This of course can be done entirely independent of the shop itself.

The second principle is that if the planner has a graphic picture of the scheduled, day-to-day loading of every machine in the shop he can see in advance which machines are going to run out first, and put the pressure on for more new orders, or for material or tooling short on orders now on hand but not scheduled. In the past the shop often became aware of the fact that a machine was going to be shut down but a short time before it actually stood idle, waiting for work. The planner knows days in advance.

With reference to job shops making separate parts for the aircraft factories, it is desirable to have someone, i.e., the planner, determine when each operation should be started. Working in the order of due dates is not enough, since the length of time to complete the parts determines when the work must begin. Moreover, there is the competition between aircraft factories for the time of the shop. Should a "hot order" received today past due have preference over one received three weeks ago which must be started today to be delivered in time to another factory? It is well known that where the shop chooses which orders to run, personal preference for jobs, knowledge of which are more profitable, likes and dislikes for factory follow-up men not to mention the amount of pressure these individuals may be able to exert all may have an influence on the factor of when jobs are to be started. Yet the parts are practically all needed in national defense, or for the British. Every order, however desirable or profitable, becomes an obligation once accepted.

It would seem as if the principle of first come, first served should in reason be established and preference given over orders that are hot or past due, and over work which must be started during the present week or in the future. This principle may be built quite simply into the method of scheduling the work on the machines. It goes without saying that there is no reason why the planner should not be governed by this principle, yet make such adjustments as the management of the job shop sees fit to specify in unusual cases. The ordinary criterion would seem to be whether the aircraft factory demanding special consideration would let the other fellow have such preference if the situation were reversed.

In the larger shops, and particularly those making assembly units or doing work requiring a great deal of tooling, purchasing materials and drawing up details of parts, it is necessary to chart out the timing of these functions. They may have to be performed for the separate parts to assure their fabrication being completed in time for them to go into sub-assemblies and final assemblies. Presumably this process of scheduling is being performed by the aircraft factories themselves in the case of separate parts farmed out to "outside production" with the due dates on the orders reaching the job shops constituting the tie-in with such scheduling. But where the shop itself performs any of these functions of engineering, procurement, or assembly, as well as fabrication, the planning work involves the coordination of these various activities, and should be set up with that in mind.

But once the shop orders for machining or fabrication of parts are written, the point of view shifts. The object is primarily machine loading. If the load to go on the machines has been studied in connection with negotiation and acceptance of orders, and charted by operations as suggested in a previous article, questions of adequacy of machine capacity have already been analyzed and necessary action taken. The scheduling of the work by particular operations on particular machines is basically an operating problem, a matter of servicing the shop and its supervision so that it does not have to worry about getting orders ready to run. The machine loading schedule will reveal even more closely the presence of bottlenecks or over-capacities, but its major function is to act as a carburetor feeding the right amount of the right work to the machines at the right time, so that they will be subject to the least disturbance by outside influence.

From this point of view the following method of machine loading now being used becomes understandable. For each job covering a separate part the planning unit creates an operation card showing the successive steps necessary for processing the part, and detailing the equipment needed to perform them. This information may appear on the separate shop orders accompanying parts into the shop or it may be available on a duplicate process card in the given department of the shop, in which

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BEAM-COLUMN END MOMENTS FOR KNOWN FIXITY COEFFICIENTS

By Frank B. Wozniak *Stout Skycraft Corp*

IN the design of pure columns the stress analyst almost invariably handles the effect of elastic end restraint by inserting the well-known "end-fixity coefficient" in the Euler equation. Frequently members having known or arbitrarily-set end-fixity coefficients must be designed as beam-columns carrying one or more concentrated lateral loads. Then the analyst has no such simple expedient to revert to. The following is a method for calculating the restraining end moments for any end-fixity coefficient less than four.

Osgood (Ref. 1) and Euler have shown that

$$P = \frac{m}{\nu L + s} = \frac{\pi^2 \bar{E} I}{L^2} \qquad (1)$$

Then

$$m = \frac{\pi^2 \bar{E} I}{L^2}(\nu L + s) \qquad (2)$$

At the critical column load $L/j = \pi\sqrt{c}$, thus

$$\frac{1}{\nu} = \frac{\pi\sqrt{c}}{\tan \pi\sqrt{c}} - \frac{\pi\sqrt{c}}{\sin \pi\sqrt{c}} \qquad (3)$$

Now, for the beam column shown in Fig. 1, between

$x = 0$ and $x = a$

$$M = M_1 - \frac{Wb}{L}x + \frac{(M_2 - M_1)}{L}x - Py \qquad (4)$$

Also, the general equation for beam column moments with concentrated loads is (Ref. 2)

$$M = C_1 \sin x/j + C_2 \cos x/j \qquad (5)$$

Notation Employed

P = Axial load

L = Length of column

$\bar{E}$ = Effective modulus of elasticity

I = Moment of inertia of column cross-section

$j = \sqrt{\bar{E}I/P}$

m = elastic restraint (in-lb per radian)

θ = Rotation at end of column (radians)

M = End moment = $m\theta$

s = length of gussets at ends

$\frac{1}{\nu} = \frac{L/j}{\tan L/j} - \frac{L/j}{\sin L/j}$

Then from equations (4) and (5)

$$y = \frac{1}{P}\left[M_1 - \frac{Wb}{L}x + \frac{(M_2 - M_1)}{L}x - C_1 \sin x/j - C_2 \cos x/j\right] \qquad (6)$$

But since $\theta_1 = dy/dx$ at $x = 0$

$$\theta_1 = \frac{1}{P}\left[-\frac{Wb}{L} + \frac{M_2 - M_1}{L} - \frac{M_2 - M_1 \cos L/j}{j \sin L/j} + \frac{W \sin b/j}{\sin L/j}\right] \qquad (7)$$

Likewise

$$\theta_2 = \frac{1}{P}\left[-\frac{Wa}{L} + \frac{M_1 - M_2}{L} - \frac{M_1 - M_2 \cos L/j}{j \sin L/j} + \frac{W \sin a/j}{\sin L/j}\right] \qquad (8)$$

If gussets are employed at the ends of the beam column, then from Fig. 2

$$M_1 = \theta_1 (m - Ps) = \theta_1 m' \qquad (9)$$

and

$$M_2 = \theta_2 m' \qquad (10)$$

Substituting (9) and (10) in (7) and (8) yields

$$P\theta_1 = -\frac{Wb}{L} + m'\left(\frac{\theta_2 - \theta_1}{L} - \frac{\theta_2 - \theta_1 \cos L/j}{j \sin L/j}\right) + \frac{W \sin b/j}{\sin L/j} \qquad (11)$$

$$P\theta_2 = -\frac{Wa}{L} + m'\left(\frac{\theta_1 - \theta_2}{L} - \frac{\theta_1 - \theta_2 \cos L/j}{j \sin L/j}\right) + \frac{W \sin a/j}{\sin L/j} \qquad (12)$$

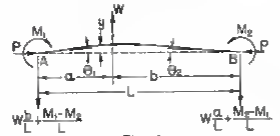


Fig. 1

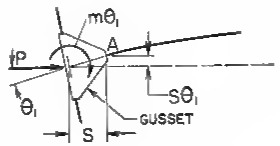


Fig. 2

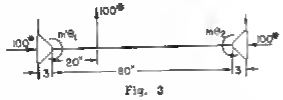


Fig. 3

Expressions (11) and (12) are both transcendental equations, and hence the simplest solution appears to be to substitute all the known values in these expressions and then solve the resulting equations simultaneously to obtain θ_1 and θ_2. Finally, for n concentrated loads

$$M_1 = m \sum_1^n \theta_1$$

$$M_2 = m' \sum_1^n \theta_2$$

Example

Fig. 3 illustrates an elastically restrained beam-column for which the end moments are to be determined. The data necessary for the solution of the problem are the following:

P = 100 lb	W = 100 lb
L = 80 lb	a = 20 in
L/j = 1.00 (radians)	b = 60 in
j = 80 in.	s = 3 in
$\bar{E}$ = 10^7 lb. per sq. in	c = 2
I = .064 in.^{4}	

From equation (3)

$$\frac{1}{\nu} = \frac{3.14\sqrt{2}}{\tan (3.14\sqrt{2})} - \frac{3.14\sqrt{2}}{\sin (3.14\sqrt{2})} = 5.84$$

From equation (2)

$$m = \frac{2 \times 9.87 \times 10^7 \times .064}{(80)^2}\left(\frac{80}{5.84} + 3\right) = 3.3 \times 10^5 \text{ in-lb/rad.}$$

Then from (9)

$m' = 3.3 \times 10^5 - 100 \times 3 = 32{,}700$ in-lb/radian

Substituting the known quantities in equations (11) and (12) and simplifying yields the expressions

$$.06 - 2.47\theta_1 - .076\theta_2 = 0$$
$$.044 - .076\theta_1 - 2.47\theta_2 = 0$$

From which $\theta_1 = .0208$ and $\theta_2 = .0114$ radian. Then

$M_1 = .0208 \times 32{,}700 = 680$ in-lb

$M_2 = .0114 \times 32{,}700 = 373$ in. lb.

References

1. Osgood, William R., Column Strength of Tubes Elastically Restrained Against Rotation at the Ends. NACA Technical Report No. 615.

2. Niles, Alfred S. and Newell, Joseph S. "Airplane Structures." Vol. II, 2nd ed., pp. 657. John Wiley and Sons, New York, 1938.

[1] Equation (6) is first expanded by substituting the expressions for C_1 and C_2 as given by Niles and Newell in Ref. 2.

IT ISN'T IN THE BOOK

The Birdmen's Perch

This month we inaugurate a new feature—the Funnybooner's Dept. We'd like to hear about the boners you pulled when you were learning to fly. I think we'll get some pretty good laughs, and of course, there's nothing like profiting by the other fellow's mistakes!

Major Al Williams, alias "Tattered Wing-Tips," Mgr., Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

FUNNYBONER, NUMBER 1

Here is the first boner I pulled while learning to fly

I had just soloed and had logged a few hours solo time, when I took the trainer up for a half hour practicing turns and figure eights When my half hour was up I glided back to the airport and prepared to land I checked the wind sock as usual but this day I must have been thinking of something else, for I started to land *down* wind The plane was an old two-seater, open cockpit plane and landed rather hot My approach was good but as I leveled off to set her down I noticed the hangars and school office were flashing by at rather a high rate of speed I kept pulling back on the stick trying to set her down, but I kept using more and more of the runway I noticed the last hangar at the end of the runway flash past, and I gunned her to come around again. As I did, I noticed another plane preparing to land in the opposite direction to which I was attempting to land

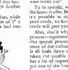
All of a sudden it dawned on me that I had landed *down* wind instead of *into* the wind

Clifford Smith, Forest Hills, L. I.

IS THERE A CARPENTER IN THE HOUSE?

Two amateur pilots were building a hangar for their plane They had been saving money for a long time to build this hangar, and they had just enough lumber on hand—and no more

Unfortunately, one of the pilots, while working, sawed a ten foot beam of 3" x 5" in half by mistake. He now had two



five foot lengths and the plans called for a ten foot beam To complete the hangar they had to splice the two five-foot lengths together And remember—aside from nails they could spare nothing, neither hardware nor wood If you had been there, how would you have helped those two fellows splice those two pieces together?

Send in your answer, *with* illustrations,

THE CHINESE HAVE THE RIGHT IDEA

Here in this country, we usually judge a man by what he has 300 hours in the air, a million dollars, or a set of twins In China, on the other hand, a person is judged by what he hasn't Bad habits, a loud mouth, or a shrewish wife, for instance.

Now, if you really want to appreciate Gulfpride Oil in the fullest you've got to take the Chinese point of view Gulfpride is important to you because of what it *hasn't!*

Gulfpride Oil *hasn't* a lot of things which might lead to inefficient lubrication in your motor because we've gone to a lot of trouble to see that these things were taken out!

To be specific, we've started with only the finest crudes. Because, while we know it's possible to make a fair oil out of poor crude, we know that only the finest crude will give you the *best* oil

Also, that's why we use the Alchlor process—experience has shown us that this special process removes up to 20% more of the carbon and sludge formers! It all boils down to this! because we've taken the trouble to see that Gulfpride has a lot of important *hasn'ts* —you've got one of the finest, roughest longest lasting oils you could put into a motor!

THIS MONTH'S WHOPPER

Dear T W T

I am the only man alive, who holds the solution to a problem which has baffled science for years

I shall explain to you why Halley's comet is not a comet but is none other than my uncle Pookie Googins

Uncle Pookie was the greatest safe cracker of all time Admired by all in that profession Safe manufacturers spent thousands of dollars inventing new safes just to baffle Uncle Pookie But he always found a way to spoil their efforts. Finally, they built a safe that was fire-proof, torch proof, bomb proof, and crack proof But that didn't stop Uncle Pookie no sir!

He had heard of the wonderful things G A G was doing so he proceeded to the nearest airport and obtained a small bottle of this amazing gas.

He poured a little of the G A G in the cracks around the safe door, calmly stood back, and flicked a lighted match at it

Well sir right then and there Uncle Pookie discovered the meaning of the saying Crime doesn't pay

You can yank my prop if that safe didn't make a noise like a cross between a thunder bolt and a gang of women at a fire sale With a tremendous howl, it left the floor and took Pookie at the belt buckle

There he stuck as she zoomed for the stratosphere

The last time he passed the earth, I noticed he and the safe were taking on a tear drop shape I figure he will come around again in about forty years and by that time I hope to invent a gun that will shoot a life line to him I'm considering using G A G instead of powder to fire it with

Flipper Lewis

P S That ring around Saturn is a friend of mine who took off in a power glider with a tank full of G A G and got his controls jammed in a left bank

Aviation's Regulated Economy

By Selig Altschul

THE air transport industry's complacency in obtaining exemption from excess profits taxation was rudely shattered by the impact of another phase of the national defense program In order to accelerate our rearmament program, the air carriers became the nation's first industry to have consented to defer contemplated expansion plans

While air line stocks did not rally appreciably when tax exemption was granted they were subjected to heavy liquidation when limitation of continued expansion became increasingly evident Interestingly enough, Pullman, Inc enjoyed better market sponsorship in the belief that it would be a major beneficiary through any action that would arrest the air lines' increasing share of the railway travel market. "One man's poison is another's meat," is an aphorism that may be alternately applied as Pullman and the air lines contend for passenger business in the years to come

Upon closer appraisal it is found that restrictions placed on commercial aircraft deliveries are not likely to seriously impede the normal growth of air transportation during 1941 It is possible, however, that should restrictions prevail a serious equipment shortage may develop in 1942

Informed sources believe that there will be no interference by the priorities committee of the NDAC with the "normal" replacement requirements of the industry It is likely however that the proposed inauguration in regular service of a fleet of 40 passenger DC-4's costing an aggregate $11,550,000 will indefinitely be postponed. Fifteen such ships are on order by American, ten by United, four by Eastern and four by Pan American Airways This equipment was originally scheduled for delivery early this year but the data was subsequently advanced until fall and it now appears that the entire program may be shelved until war exigencies no longer exist.

Current traffic trends may not only permit the industry to conveniently defer new equipment purchases but it may prove sound business practice to temporarily suspend new plane deliveries Passenger traffic on the domestic air lines for November showed a sharper seasonal drop from October than in any year since 1937 Preliminary reports further indicate that December traffic also resulted in a sharp seasonal decline The disappointing traffic in recent months is attributed to the recent series of accidents and adverse flying conditions Past experience has demonstrated that unless an exceptional safety period is maintained through the fall and winter months, traffic has a tendency to drop off rather sharply from November to March or April This trend was vividly illustrated by the traffic experience in the early months of 1937 following the accidents of late 1936 and duplicated at the outset of 1938 as a result of more unfortunate crashes in the fall of 1937

While available capacity may suffice to serve the traffic demands of the months immediately ahead, the requirements of summer travel may necessitate an exacting examination of new equipment needs In spite of temporary setbacks resulting from accidents and other causes, the secular trend of air travel continues strongly upwards and is bound to assert itself

The industry as a whole should be able to handle another sharp increase in passenger traffic during 1941 without necessarily adding to its equipment supply Individual lines, however, will be affected in varying degrees Those companies who acquired a substantial number of planes during 1940 will obviously have materially improved their positions for the immediate future

Greater efficiency through an increase in the load factor may be the medium through which the air carriers may augment their passenger-miles with their present equipment The profit possibilities inherent in any increase in the load factor from present levels is astounding For example, during October 1940, the industry as a whole had a load factor estimated at 64 percent and flew 115,474,262 revenue passenger-miles. An increase of but 2½ percent in this load factor would add approximately 4,394,000 passenger-miles a month, which translated at an average rate of 5c, would mean increased monthly revenue of about $220,000 Practically all of this increased gross could be expected to flow through to net as the added cost of handling would be small

Using October 1940 results, an approximate projection can be made as to the passenger growth potentialities present in each company through an increase in the load factor The position of the major six air carriers in this respect is presented in Table I As new planes have been added by most of these companies since October, an increase in the load factor will exert a greater influence upon earnings than that indicated These estimates are also subject to seasonal traffic variations of the various companies

As with all statistical projections, however, such estimates need be tempered with actual operating experiences in order to present a realistic picture. Authoritative sources believe that as a practical operating problem the average load factor for the major carriers cannot economically exceed about 70 percent Any further increase in the ratio from this level may necessitate heavy operating costs along with the severe curtailment of "short-haul" schedules This later development could alienate the good will of an important segment of air travelers who are becoming increasingly important to the continued growth of the industry.

The load factor for American Airlines has a tendency to exceed the industry average primarily because its routes gridiron a heavily populated area. While TWA's load factor averaged 66.7 percent for October, it is found that the popular "Stratoliner" maintained a ratio of 82.4 percent for that month thus making the closest approach to the theoretical but unattainable 100 percent capacity mark

The industry as a whole, if it desires, can adopt certain measures to obtain greater utilization of its present equipment For example, the three major lines operating between New York and Chicago could coordinate and read-

(*Turn to page* 114)

Table 1

Projected Monthly Revenue Increase Upon Increase in Load Factors

	October 1940		Estimated Increase In Load Factor By	
	Load Factor %	Available Seat Miles	2½%	5%
American	71.48	40,534,000	$61,818	$123,835
Eastern	65.08	20,900,000	33,637	67,273
Northwest	49.70	10,787,000	13,497	26,993
Penn Central	57.21	7,490,000	9,362	18,728
TWA	66.71	28,113,000	35,150	70,299
United	66.41	37,794,000	47,243	94,485

Barron's Stock Averages

	Aircraft	Air Transport	50 Stocks
Dec 6, 1940	39.72	26.94	76
Nov 29, 1940	39.88	26.91	77
Nov 22, 1940	41.32	28.41	78
Nov. 15, 1940	42.75	29.03	82
Dec 8, 1939	42.30	19.82	80

HONING ENGINE PARTS

How to speed up engine work at time of major overhaul

By Lawrence S. Martz
Micromatic Hone Corp.

Fig. 1. This honer can be adjusted to take radial cylinders or in-line cylinder blocks.

RECOGNIZING that the efficiency and safety of any future aircraft training project depends substantially upon the maintenance provided for motors and auxiliary airplane parts, the government purchased equipment in 1936 to be used at six army air depots and several naval air stations for reconditioning aircraft engine cylinder bores. Regulations in the government air services at that time required complete reconditioning of all motors at the end of every 400 hr. of actual flying time. The conservation of mechanical efficiency and safety in this work is of utmost importance. This is now assured by the use of machines, tools, fixtures, and processing methods which have thus been established by trial and use in actual service, for reconditioning aircraft engine parts to factory specifications.

The success of this project is assured by the use of the same basic engineering principles which are designed into all equipment used by the engine manufacturers. It is the purpose of this article briefly to survey the extent of adoption of this important maintenance policy as related to parts and assemblies so processed.

Cylinder Barrels

Badly worn engine cylinder bores, in both radial and straight-line engines, are honed without any other correctional, regenerating operation, such as grinding, in two or more operations. Severe distortions, ranging up to 0.015 and 0.020 in. out-of-roundness and taper are corrected in a rough and finish honing operation. Accuracy is generated within a total tolerance of 0.0003-in. Stock removal frequently ranges from 0.010 to 0.025-in. on the diameter. Size limits are established by refitting of pistons and rings in steps of 0.005-in. Surface finish produced by this second, or finish, honing operation, commonly using 400-grit stones, is from 3 to 5 microinches, rms, both circumferentially and longitudinally in the bore.

Some engineers in the aircraft industry believe that all processing marks in newly finished or reconditioned bores should be parallel with the wear marks which result from operation of the assembled surfaces. It is their belief that this type of surface finish permits the closest, least resistant, approach of surface irregularities on moving surfaces, thereby reducing initial frictional wear, increasing compression, reducing blowby and minimizing the probability of scuffing or galling. This premise has been widely adopted by government personnel in air depots. They have been approximating this type of finish for several years with an additional processing operation following honing. A Barnes drill honing machine equipped with a Micromatic honing tool arranged for straight-line lapping, as shown in Fig. 1, is used in this operation.

Cast-iron laps are mounted in conventional honing tool stone holders, and impregnated with abrasive paste, composed of 500 gram Aloxite Aluminum Oxide, mixed with light machine oil, or, a mixture of L-41 Carborundum fine abrasive mixed with oil, and 60 percent kerosene. A stroking motion only is imparted to the tool, which is hand indexed slightly between strokes by means of the lever located at the top of the machine spindle. Approximately 25 indexings are necessary for one complete rotation of the tool. The laps have a tilting or rocking action in the stone-holders, and are free to seat themselves against the walls of the bore. Stock removal in this operation rarely exceeds 0.0002 to 0.0004-in. on the diameter, and the finish produced is within 6 to 11 microinches, rms, circumferentially, and from 3 to 6 microinches, rms, longitudinally.

The latest, successful means adopted

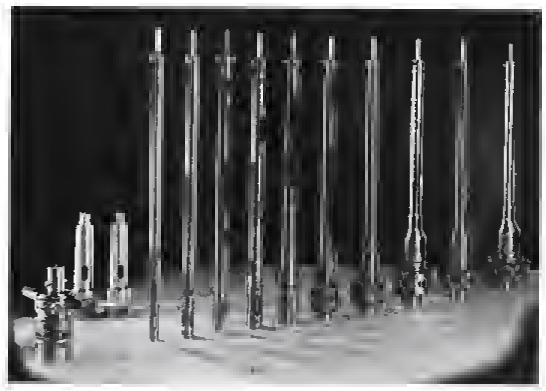


Fig. 3. Micromatic tools for honing engine parts of several different diameters

for generating this new co-directional drawfinish is illustrated at the right in Fig. 2. This tool is provided with interlocking abrasive stones, arranged in such manner as to present continuous, annular abrasive contact in the bore at all times during operation. These tools are used in the second, or finish, honing operation to produce the approximate final size and conventional crosshatched, smooth honed finish, with the tool being rotated and reciprocated as in the conventional honing actuation. For co-directional drawfinishing, the rotation of the tool is stopped and it is then reciprocated longitudinally in the bore, with a few degrees of indexing applied between strokes in some applications. Typical final accomplishment produced by this tool shows circumferential reading of 5 to 6 microinches, and longitudinal reading of 2 to 3 microinches, both rms.

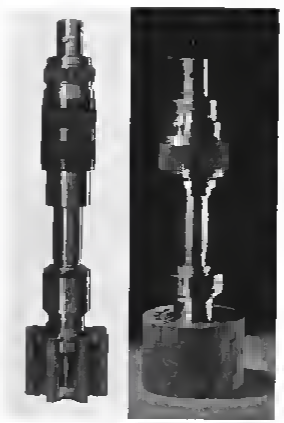


Fig. 2. The first honing operation is done with the tool at the left. Second operation is done with tool at the right.

Master Connecting Rod and Articulator Rod Bores

During the latter part of 1940, the government aircraft services have adopted honing applications for reconditioning other engine parts. All such applications have been adopted and used in original manufacturing process within the past three to five years. A majority of these parts comprise bores of extremely shallow length in proportion to diameter, they constitute a difficult reconditioning problem for obtaining factory-specified standards by other processing methods. It has now been formulated in a combined project with standardized equipment, tooling and fixtures. An especially designed honing machine is used which is equipped with a two-spindle head, one is a conventional type, gear driven, for use in bores of approximately 1:1 or more, diameter/length ratio, and the other is a special type Micromatic spindle arranged with an adjustable oscillating stroke, mechanically actuated, to be used in bores where the length to diameter ratio is less than 1:1. Typical tooling and fixturing for these parts is shown in Fig. 3.

The crankpin bores of master connecting rods, approximately 2.906 in.

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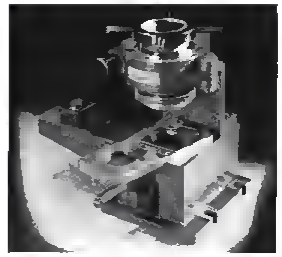


Fig. 4. A fixture for honing of master connecting rods of radial engines.

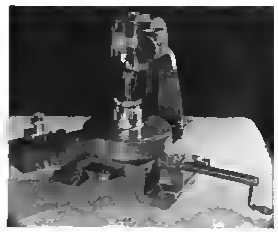


Fig. 5. Tandem knuckle pin bores are honed in this fixture.

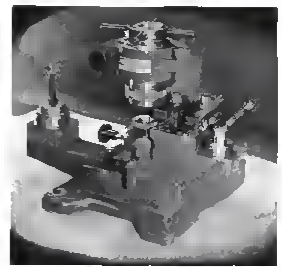


Fig. 6. Wrist pin bores in master and connecting rods are honed in this fixture.

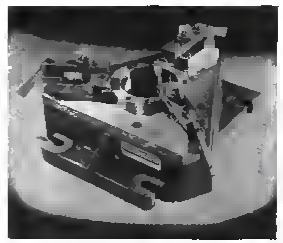
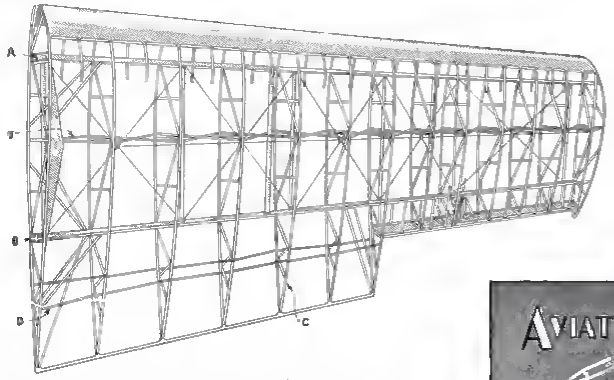
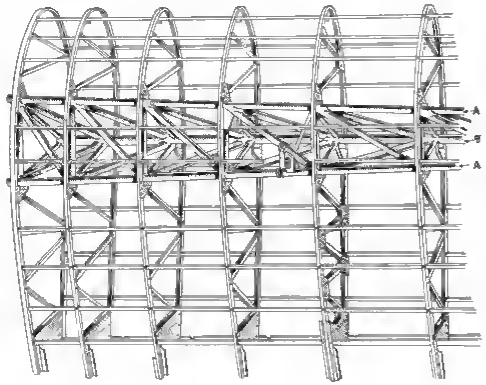


Fig. 7. A fixture for honing several different engine parts. Details are in the text.

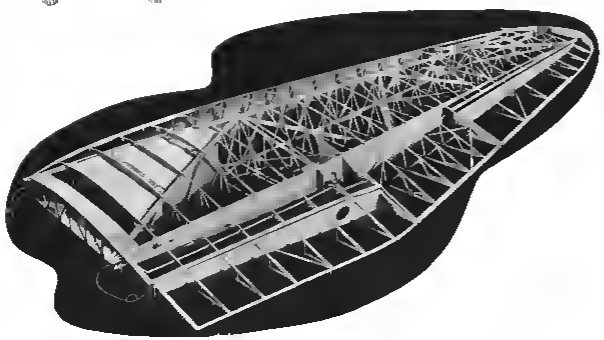


Above: The Taylorcraft wing construction utilizes two spruce spars attached to the center wing construction by fittings at "A" and "B". The leading edge is formed of aluminum alloy riveted to the drag and nose-ribs. The unique process of forming the nose to these ribs is accomplished by corrugating the lateral part at a T-section while bending. "D" are the cloth ribbons connecting the drag ribs "C".

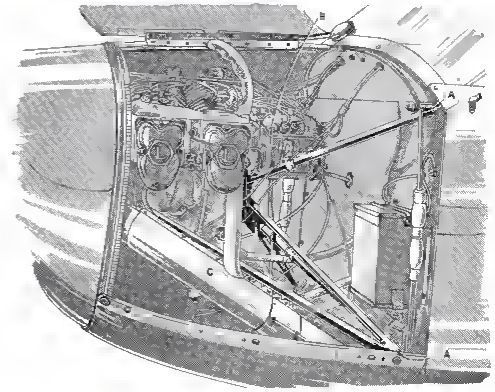
AVIATION SKETCH BOOK OF DESIGN DETAIL



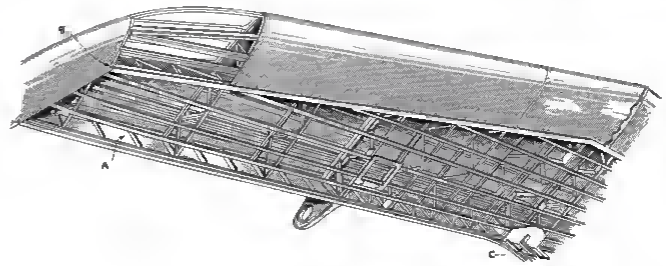
Left. The wing spar and rib construction of the Spartan Executive, employs a single main spar built up of 3 large aluminum alloy tubes "A" and "B" designed to take the major part of the stress. Built of truss type construction this spar tapers to the wing tip and is riveted to the ribs by appropriate fittings.



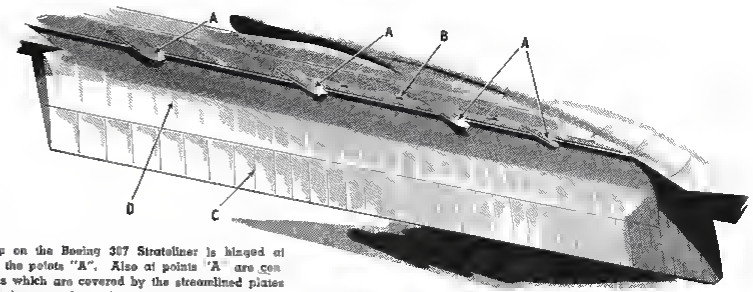
Right. The Stinson wing construction illustrates a method of cross drag bracing between the front and rear spars. The front spar is set straight all the way in from the wing tip, but branches at a point just outward from the gas tank into two sections, one going to the front and one to the rear fitting. These spars are made of aluminum alloy tubes and the rest of the wing is of all metal aluminum alloy construction. With the two spars having this truss type construction the drag ribs can be practically eliminated. The wing slot can be seen on the leading edge near the wing tip.



Right. The engine mount supporting the geared Lycoming "7S" in the Funk Model L light plane is attached to the fuselage structure at two points "A" on either side of the firewall and to the motor at point "B", and at another point under the front cylinder on either side of the engine. An interesting exhaust system "C" is employed in the Model L and this section is joined by exhaust pipes going from the two cylinders on the other side.



Above. The construction of the Consolidated PBY-1 stabilizer is made up of angle stringers and "I"-sections. The nose section back to the first third "B" of the stabilizer is attached in one section, part of which is shown in the drawing. The rear spar "A" is reinforced at the top and bottom by angle sections at either side forming a split T-section with reinforced stiffeners riveted between them. "C" is the rear attachment fitting for the fin.

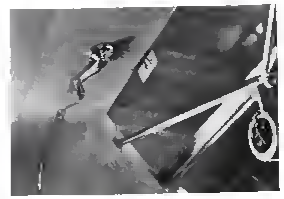


Right. The flap on the Boeing 307 Stratoliner is hinged at both ends and the points "A". Also at points "A" are control mechanisms which are covered by the streamlined plates as shown. "B" is a ventilation hole for the main section of the wing. The fabric of the flap is attached to the rear ribs at "C" while "D" is the main spar running the full length.

range of vision as compared with the former two-panel window

Specifications of Model BC 12 65

Wing span	26 ft.
Overall length	22 ft.
Overall height	6 ft. 8 in.
Wing area	169.0 (including ailerons)
Weight empty	700 lbs.
Gross weight	1200 lbs.
Wing loading	7.1
Power loading	13.4
Maximum speed	105 mph.
Cruising speed	85 mph.
Stalling speed	38 mph.
Rate of climb	600
Service ceiling	15000 ft.
Cruising range	275 mi. (18 gals. fuel)
Fuel consumption (at cruising speed)	4.0 gals. per hr.



New ceiling type tab control crank, with indicator as installed in the roof of the new Taylorcraft.

Taylorcraft

DUOTONE DELUXE

INTERIOR STYLING is one of the main features of the new 1941 Taylorcraft Duotone Deluxe. Emphasis has been placed on this by the designers because they feel that the private market is becoming increasingly conscious of aircraft styling. Carrying out this idea the Duotone Deluxe Model on the exterior has the upper half of the plane including wings and tail surface painted in light colors and the lower half in dark.

The windows of the new model have received a great deal of attention. All windows are considerably larger than in any previous Taylorcrafts. The door of the new ship incorporates reinforced plywood construction and is cushioned with sponge rubber weatherstripping. This type of cushioning gives greater warmth to the cabin and cuts down engine noise.

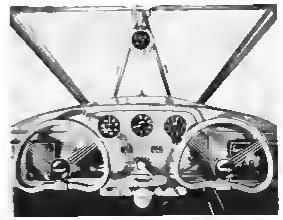
The Deluxe Model offers considerable additional equipment which was not found in previous airplanes of this company. These include compass, brakes, dual ignition, navigation light wiring, and auxiliary six-gallon gravity-feed wing tank.

The lay-out of the instrument panel has received considerable attention from Taylorcraft's engineers. Placement of instruments has been arranged along lines which are known as "Proper Functional Arrangements." This saves the pilot from the necessity of looking from one side of the instrument panel to the other during the flight as he can concentrate his attention on the set of instruments in which he is concerned. All instruments are mounted in rubber cushioning.

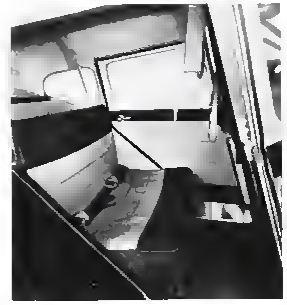
The cabin of the new Deluxe Model is roomier than formerly and the baggage compartment is larger allowing for an additional 20 lbs. of luggage. Head room has been increased and the installation of a window has extended the cabin ceiling so that a shelf has been built in behind the seat.

The trimming tab control is now operated by turning a chromium handle in the cabin ceiling. An indicator automatically shows the rate of adjustment.

New automobile-type door handles, self-closing door latches and keylock on doors combine the advantages of both safety and convenience with appearance. The windows open outward by means of the special Taylorcraft locking lever. Single-pane windows are new this year, providing increased



View of the dashboard illustrating the functional arrangement of instruments and installation of the Loranaire



A great deal of attention has been given to interior upholstery in design as can be seen from this view of the cabin

THE JUMO 205 AND 207

Germany has achieved successful operation with these diesel engines in long-range flights

THE Junkers Jumo 205 diesel which was first introduced to the aviation world in 1933 undoubtedly is the best known compression-ignition aircraft engine today. It has been used exclusively in landplanes, seaplanes and flying boats for both civil and military purposes. Its success in the airliners and mail planes of Deutsche Lufthansa over land and sea has established it as a desirable power plant for long-range flights. Its use in the small bombing planes of the German Air Force has shown that its economic advantages also are appreciated.

The Jumo 205 with its six water-cooled in-line cylinders and two pistons in each cylinder and two crankshafts is to all intentional purposes a twelve-cylinder engine. Operating on the two-cycle principle it is designed so that valve gear is eliminated by having the pistons cover and uncover the inlet ports and the exhaust ports. The one-piece cylinder block is bored to receive six steel cylinder liners but there are no cylinder heads as the combustion chambers are formed between each pair of piston heads. A gear train comprising five spur gear wheels connects the two crankshafts together and transmits their power to the propeller shaft.

The parts which caused the most trouble before the final design was arrived at were the cylinder liners and the piston rings. The unusual length of the liner and the uneven distribution of heat and stresses necessitated considerable research which ended in the liner being made with numerous small water channels around its mid-portion to provide additional cooling area. The problem of gas leakage past the rings due to the high compression ratio of 17 to 1 was solved by fitting L-shaped "fire-rings" around steel "fire-plates" attached to the tops of the piston crowns. Rough running was eliminated by installing a hydraulic vibration damper between the gear train and the propeller shaft.

The scavenging air necessary for this two-cycle diesel is provided by a gear-driven blower with an impeller ratio of 8.9 to 1. The blower is attached to the rear of the cylinder block and the air is delivered through manifolds along each side of the block to the inlet ports around the lower ends of the cylinders. Although 60 percent excess air is provided its pressure is only 5.7 lb. per sq.in. which does not give appreciable supercharging effect at altitude. In other words, the engine is equipped with a ground blower.

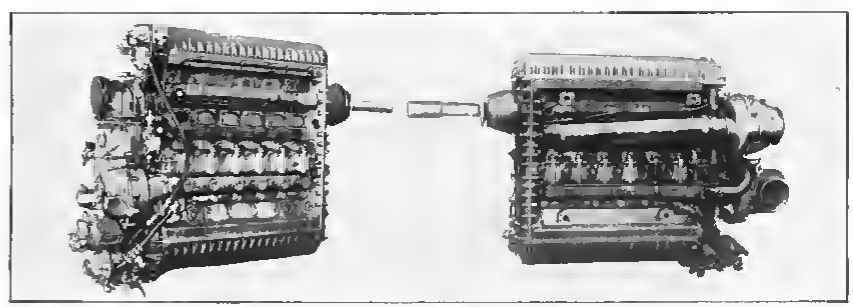
Two fuel injection pumps and four injectors are provided for each cylinder. The pumps are arranged in sets of six along each side of the cylinder block and each one is connected to two injectors. The pumps are designed so that throttle control and timing control are combined in the one lever. The injection pressure varies from 4,250 lb. per sq.in. to 8,500 lb. per sq.in. depending upon the engine speed. The pumps are small but rugged and operate for 1,000 hours before overhaul.

The cooling system and the lubrication system function in the same manner as in a water-cooled gasoline aircraft engine. The accessories mounted on the rear of the engine are of standard manufacture. Compressed air originally was used to start the engine but this has been superseded in favor of an electric inertia starter or a cartridge (gas) starter of conventional type. The weight of the cooling system including radiator, piping, auxiliary tank and water is 288 lb.

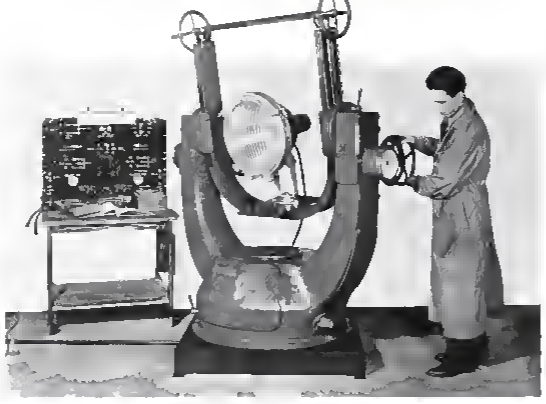
When the Jumo 205, or rather the Jumo 5 as it originally was known, was introduced it developed 550 hp. and had a specific weight of 2.43 lb. per hp. In due course the crankshaft speed was increased so that the Jumo 205 C developed 600 hp. at 2,200 r.p.m. Now the Jumo 205-E is rated at 700 hp. at 2,500 r.p.m. A further increase in crankshaft speed has been made possible in the case of the Jumo 205-D which develops 880 hp. at 3,000 r.p.m. The Jumo 205-E which is used extensively in Germany has a specific weight of 1.43 lb. per hp. and a specific output of 0.87 hp. per cu.in. of displacement.

The addition of an exhaust-driven supercharger to the Jumo 205 has enabled the engine to develop still more power for take-off and at high altitudes. When equipped in this manner it is known as the Jumo 207 which incidentally is a strictly military engine. The rated output of the Jumo 207 is 1,000 hp. at 3,000 r.p.m. for take-off and this output is maintained to an altitude of 26,000 ft. Its continuous cruising output at high altitudes is 800 hp. at 2,400 r.p.m. Strengthening the en-

(*Turn to page* 106)



Left: The 700 hp. Junkers Jumo 205 E diesel equipped with a ground blower is the latest compression ignition engine for civil aircraft. Right: The 1,000 hp. Junkers Jumo 207 diesel developed from the Jumo 205 and equipped with an exhaust-driven supercharger.



By means of handwheels on top and right side the unit may be rotated about either axis to within one minute of any angle.

By H. W. Wrigley
Westinghouse Electric & Manufacturing Co

TESTING AN AVIATION FLOODLIGHT

LIGHTING EQUIPMENT for aviation is not built on an assembly line. Each unit is assembled painstakingly to precise specifications, then put through its paces in a series of exacting laboratory tests. As a contribution to the safety of all those who ride the skyways of America, the lighting division of the Westinghouse Electric & Manufacturing Co. tests such equipment on a new photometric range which is somewhat ahead of current commercial practice. This range is used for obtaining the candlepower distribution of floodlights, searchlights, beacons, and similar lighting units. It has been so constructed as to make possible complete photometric explorations of the light beams from all types of light projecting units from the narrow beams of 2 to 3 deg. spread obtained from searchlights to the widest beam spreads obtained from floodlights and incorporates the latest knowledge available for the complete and accurate testing of the light-projecting equipment for which it was designed.

The floodlight-testing range consists essentially of two separate pieces of equipment. These are the trunnion or special movable platform upon which the lighting unit under test is mounted, and the light-intercepting apparatus for measuring the intensity of the beam in any desired direction. The trunnion consists of a small platform, rotating about both the horizontal and vertical axes, upon which the lighting unit being tested can be mounted and rotated to any combination of horizontal and vertical angle desired. This rotation is accomplished in the following manner:

The platform upon which the floodlight is placed is mounted in a steel bow rotating vertically about a horizontal axis. This bow in turn is swung in a cradle rotating horizontally about a vertical axis. By means of these two axes about which the platform can be rotated the lighting unit can be adjusted to any particular combination of vertical or horizontal angles desired, or it can be rotated about either axis independently of the other. Other features incorporated in this trunnion are a floodlight positioning adjustment, vernier dials for angular measurements and suitable brakes and locks for holding the floodlight in a fixed position while a reading is being obtained. The floodlight positioning adjustment was obtained by mounting the bow on turn-screws to permit easy adjustment of the floodlight to the correct position in relation to the two axes of rotation. The vernier dials are so constructed that the angular setting, either vertical or horizontal, may be determined accurately to within a few minutes of a degree. In addition, these dials are so located and lighted that they are readily visible to the operator of the trunnion, thus contributing to easy and rapid testing. The locking features enable the operator to fasten the floodlight at any desired angular setting without danger of shifting while a reading is being obtained.

The light intercepting apparatus receives the light beam upon an unobstructed sheet of flashed opal glass which can be screened to intercept any desired solid angle. The brightness of the reverse side of this glass panel is viewed by a group of barrier layer cells connected in parallel and so mounted that this combined output, measured by means of a microammeter of the intercepted light. An adjustment feature is included in the mounting arrangement of the cells so that a full scale deflection of the microammeter can be utilized for whatever lighting unit is being tested.

Variable test distances up to and including 100 ft. are provided for in this range. This is sufficient distance for the accurate testing of all units for which the trunnion was designed. Any unit not exceeding 30 in. in diameter normal to the beam axis can be mounted and tested in the trunnion.

All controls and instruments needed for these tests, including the microammeter used with the light intercepting apparatus are mounted by the trunnion in order to facilitate ease of operation. This feature makes possible the complete testing of a unit by only one observer, and the layout is such that plenty of light is available for operating the control and reading the instruments without reducing in any way the accuracy of the results. Curtains and screens are provided so that no extraneous light can reach the light intercepting apparatus.

Calibration of the instruments used on this test range is provided for in additional laboratory equipment available. A bar photometer, integrating icosehedron, and distribution range, with the proper control equipment, provide all necessary apparatus for calibration and a supply of lamps standardized for candlepower and for lumen output is maintained for insuring primary accuracy.

Aviation—RADIO

Dialing the Air Waves with Don Fink

Ultra-High Frequency Radio for Instruction

An important development in ultra-high frequency radio flight instruction equipment has been announced by Stu Babcock, president of Electronic Specialty Co., Glendale Calif. Two basic units comprise the equipment, the Range transmitter for use by an instructor on the ground, and the Ranger pre-tuned receiver for use by the student in the airplane. The advantage of such equipment is that one flight instructor can observe the practice flights of one or more students and correct or caution them by radio. Substantial savings in solo time and reduction in flight hazards are claimed.

Two types of receivers are built, both of which are automatically placed in operation when the headphones are plugged in. One is a straight receiver operating on the pre-tuned frequency of the transmitter, and the other is a receiver and intercommunication system whereby an instructor in the plane can talk to the student in addition to the student receiving instruction from the ground. Range of the transmitters is from 5 to 10 miles, permitting relatively large numbers to be operated in any training area without interference. Weight of the receivers is 2 lbs 12 oz., and the battery about 5 lbs. Frequencies on which the equipment may be operated are 33,420, 33,660, 37,860, and 39,060 kc.

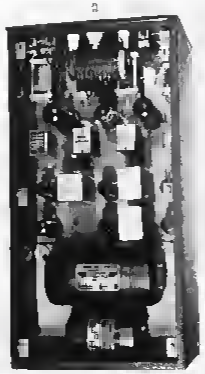
Ranger Flight Instructor Transmitter.

Crystal-Controlled Transmitter-Receiver

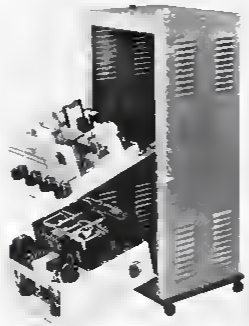
Communications Company, Inc., of Coral Gables, Florida, has recently announced a new combination aircraft "unit", model 90, a 20-watt pre-tuned transmitter and a crystal controlled pre-tuned receiver mounted together in a standard ATR case. Four crystal-controlled frequencies are provided in transmitter and receiver, at any four points within the range from 2900 to 6700 kc. Model 90 is a moderately priced transmitter-receiver, designed particularly for the itinerant flyer who wants the ability to communicate with airline ground stations, for example, as well as on the standard itinerant frequencies at 3105 and 6210 kc. A single four-pole selector switch selects the transmitter and receiver frequencies in pairs, simultaneously making tuning virtually automatic. The equipment can be controlled remotely if desired. The unit contains two generators for power supply, and makes use of a 6L6 tube in the transmitter output. It weighs 36 pounds completely equipped.

This company also produces ground station equipment for communication and airport traffic control. Model 60 is a 150-watt four channel telephone transmitter for aircraft ground stations and general point-to-point communication, operating on any of four channels. The frequency channels are selected by relays which can be operated over short distances remotely over multipair telephone cable using a rotary or push-button switch operation. For longer distances, a Strowger automatic dial-telephone stepping-switch system can be supplied. The r-f line-up comprises a 6F6 crystal oscillator, 6V6 buffer and 813 beam power type final r-f amplifier, modulated by a pair of 811's in class B. Provision is made for including as many as 16 crystals for frequency control providing alternative adjacent channels in each frequency range. The unit is mounted in a rack panel assembly.

The traffic-control transmitter, model 80, is a 50-watt outfit operating in the frequency range from 100 to 150 Mc. The transmitter is completely crystal controlled, and the crystal control unit, including the crystal oscillator and first buffer or multiplier stage are mounted in a single easily-removed plug-in unit. Two such units may be used, one of which may be sent out for a frequency check while the other remains in operation. The speech amplifier, a 6C5, is followed by a pair of 6F6's driving a pair of 809's which modulate the final amplifier, a type 829 double beam power amplifier. The r-f chain includes a 6L6 crystal oscillator, a 6L6 first multiplier, followed by two HK-24 multipliers which drive the final. The modulator and r-f units are mounted on racks which slide out from the cabinet, permitting easy access for checking and servicing.



Communication's Company's Model 90 transmitter-receiver.



Model 80 transmitter—with racks extended.

Simplifying Airplane Maintenance

Self-Sealing-Coupling, now being tested by the Army Air Corps, makes possible the faster exchange of airplane power units

By F. Peter Hirsch *Consulting Engineer, Aeroquip Corp*

IT is now generally known that most German military airplanes are equipped with Standard-Power-Units These power units are interchangeable, and thereby facilitate the maintenance in service and field. They comprise the engine, its mount, and all accessories, including generator, hydraulic-, vacuum- and low pressure-pump. The power unit is attached to the fire wall with four bolts and after the various liquid-carry lines, as well as electrical conduits which lead from the power unit to the fire wall, are disconnected, it can be removed

Obviously it is of utmost importance to cut down the time required for an exchange of such a power unit as much as possible The faster the exchange can be effected, the quicker the airplane can be put back to service It has been frequently demonstrated that airplanes of the German Air Force can take off with a new power unit in about 20 30 min. after the plane has landed

This achievement has been made possible by a close cooperation of all concerned and last but not least, by the installation of a recently developed device, known as Self-Sealing-Coupling These Self-Sealing-Couplings are installed in the firewall, and permit the disconnection of all liquid-carrying pipe lines, without either loss of fluid or inclusion of air into the system. All lengthy operations of draining the liquid from the various systems and reprimng after reconnection of the pipe lines, are therefore eliminated

An improved type of Self-Sealing-Coupling which has been developed by the Aeroquip Corp. of Jackson, Mich. has just been extensively tested by the Army Air Corps. Its design and method of operation will be readily understood from the study of the illustrations Fig 1 shows the coupling disconnected The two halves are connected in the customary manner, i e , by screwing or unscrewing a union nut In practice it has been found that the time required for dis- and reconnecting of such a Self-Sealing-Coupling takes about 20 seconds

In Fig 2 the two coupling halves are shown disconnected The left half consists mainly of a body with flange Inside is a valve which is held against its seat by the pressure of a spring This pressure is augmented in proportion to the pressure of the liquid within the pipe line. The other half consists of a body with a tubular valve which is fixed in the body, and a sleeve sliding on the outside diameter of the tubular valve The sleeve is held against the seat of the valve by the force of a spring The pressure pertaining within the pipe line tends to increase the force of the spring inasmuch as the liquid has access to the chamber which surrounds the tubular valve In other words, the design of the two coupling halves is such that the pressure within the pipe system tends to maintain the two halves in contact when connected, and increases the sealing arrangements when disconnected In consequence, leaks are not likely to occur through vibration in service.

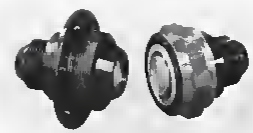


Fig 1 Self-sealing coupling disconnected

Fig 2. Section through disconnected coupling

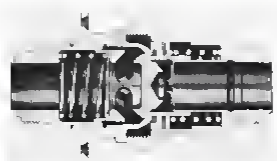


Fig. 3 Coupling connected—valves closed

On connecting the two coupling halves (Fig 3), the seating portion of the left half makes contact with the seal which is provided in the right half As can be seen, all air between the seating members and valves is excluded instantaneously with rendering the seal tight. By screwing the union nut further into the threaded portion of the flanged body, the latter one is moved axially in relation to the fixed tubular valve, carrying the sleeve with it towards the right in the illustration

There are many more applications for these Self-Sealing-Couplings, particularly in the hydraulic system In case that undercarriage units are manufactured in a separate plant or department, they have to be tested and the hydraulic system therefore has to be filled and primed When Self Sealing-Couplings are installed, no further operations are required, inasmuch as the complete unit can be shipped already primed for immediate installation on the airplane The same refers to wing assemblies whenever hydraulic flap operation is provided Also, it is of advantage to provide Self-Sealing-Couplings on hydraulically operated brakes It has been proved that the time for the exchange of one wheel including the brake, could be reduced from 77 min to 7.5 min after the installation of a Self-Sealing-Coupling To speed up the testing of the hydraulic system of an airplane by an independent pressure supply source which is usually provided on the airport, one half of the Self-Sealing-Coupling can be installed as outboard-connection on the airplane, while the other half is connected to the ground supply source There are other examples of installations, however it would be beyond the purpose of this article to go into further details

In conclusion, it can be said that the installation of Self-Sealing-Couplings is not only of great value to the airplane manufacturers, but more or less a necessity, in order to meet modern requirements of civil and military service.

BUYER'S LOG BOOK

What's New in Accessories, Materials, Supplies, and Equipment

One leak in the financial stability of business, that arising from errors and misunderstandings of oral messages, can be plugged by the TelAutograph transceiver, a new development of which, Model G, has been brought out by the TelAutograph Corp., New York City. Compacter, more pleasing in its exterior, and with clearer vision of messages while writing is being transmitted and received, the new model has been developed to operate directly from alternating current. Of special interest to the engineering department is that not only written messages but also sketches, are reproduced instantly in facsimile. Like the telephone, the telescriber is rented for a few cents a day with servicing included in the rental—AVIATION, *January, 1941*

The aviation industry is known for near-miracles, but the new Firestone static conductor tires will surprise some people as much as the first flight itself. The Firestone Rubber Co., Akron, Ohio has worked out a new compound which transforms rubber from an excellent insulator into an electrical conductor. Used on airplane tailwheel tires, all stored up static electricity will be discharged harmlessly into the ground upon contact, thus eliminating not only a frequent and disagreeable annoyance to airline agents, but a considerable fire hazard as well.—AVIATION, *January, 1941*

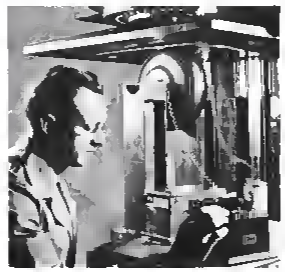
A new 4½-ton portable hoist, the "Pul-Lift", has just been brought out by The Yale & Towne Mfg. Co., Philadelphia, Pa. The new hoist has the same safety and construction features as previous models, which now range from ¼ to 6-ton capacities. The 'Pul Lift' operates equally well in horizontal or vertical position, and is ideal for almost any type of maintenance job.—AVIATION, *January, 1941*

Every once in a while in this aviation business something comes along to make us fall right out of our swivel chair. Today it is the new Lear Avia siren to tell us when to jump out of an airplane. Not that we have any intention of ever jumping out of any airplanes. But in the army they do it, and especially in some of the big bombers, where the crew is widely scattered through the ship, it is vitally important that so important a command as "Bail-Out-As-Fast-As-Possible" should be given in an unmistakable manner. This is accomplished now by the Lear Avia siren developed by Lear Avia, Inc., Dayton, Ohio, and now being mounted on various military planes. Weighing only 1-¾ lb. and available for operation on either 12 or 24-volt systems, the Lear Avia siren is said to utter a shriek so loud that it is guaranteed to scare everyone right out of the airplane, no matter in what remote corner they may be lurking—AVIATION, *January, 1941*

An entirely new idea in the field of light platform trucks for aircraft factory inter-department transportation has been incorporated in the Electric Pony Express designed and manufactured by the Rocky Mountain Steel Products, Inc., Los Angeles, Calif. Fabricated on the principle of airplane construction, the design delivers maximum payload with minimum dead weight. With speeds up to 6 m.p.h. in either direction, and front wheel drive for maximum power in a small-space maneuvering, this truck is the answer to many problems of factory and warehouse transportation. The control column is located in the front center of a 36x78 in. deck, providing ample space on either side for loading bar stock, tubing, or other long materials. One Southern California aircraft builder who operates a fleet of 23 such trucks equipped with Exide or Gould batteries, has found that battery recharging cost averages about 1 cent per hour. Batteries may be charged in the truck, or quickly removed where it is desirable to keep the truck in service while spare batteries are being charged.—AVIATION, *January, 1941*

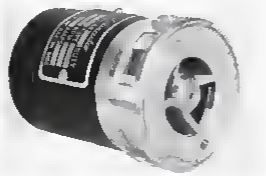
With bombs bursting in air and millions of bullets and shells ripping the firmament, the combat pilot has little chance of surviving such a holocaust as that of the modern blitzkrieg unless some protection is provided. To meet this need, Jessop Steel Co., of Washington, Pa., is now supplying in quantity special steel armor plate, curved to deflect bullets and also to fit airplane seatbacks and bottoms. In fighter planes, the engine usually interposes its bulk between the pilot and any bullets from that direction, but the tactic of all aerial combat is to get on the enemy's tail and pour bullets in from behind. Jessop steel plate will now guard the air warrior's Achilles' heel.—AVIATION, *January, 1941*

New TelAutograph Model G transceiver

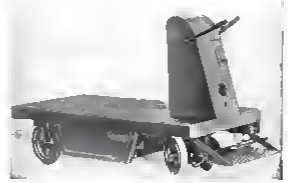


Firestone static conductor tire

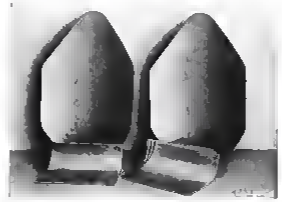
Yale & Towne "Pul-Lift"



Lear Avia bail-out warning signal siren



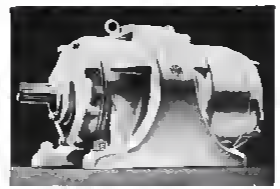
Rocky Mt. steel product express truck



Jessop steel armor plate

Sieberthaler propeller governor test unit

Am. Phenolic "AN" elec. connector



U. S. Elec. Motors gear reduction unit

Elastic Stop Nut Corp. a nut

Aviation maintenance department people will prick up their ears at announcement by Sieberthaler Mfg. Co., Kansas City, Mo., of a new propeller governor test unit, Type 102, designed to permit bench testing. Unit consists of a mounting pad with necessary adapters for various types of governors (for both hydraumatic and electric type propellers), an electric motor with variable speed drive, accurate means of measuring the governor RPM, pressure gages and calibrated flowmeter. Complete indicating devices are provided to observe operation of the governor under service conditions and permit accurate adjustments of the unit for optimum operating conditions.—AVIATION, *January, 1941*

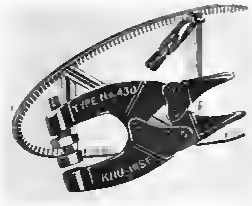
A new series of electrical connectors for aircraft is announced by American Phenolic Corp. of Chicago. "AN" shells, made in accordance with Army-Navy specification AN-9534, are of aluminum, elements of high dielectric bakelite. Features include 4 types of shells in 18 different sizes for cables or conduit from ⅜ in. to 2½ in., male and female elements having from one to 42 contacts with current carrying capacities from 2 to 200 amperes.—AVIATION, *January, 1941*

New double and triple reduction geared electric motors up to 30 horsepower at 91 rpm have been added to the U.S. Syncrogear line of the U. S. Electrical Motors, Inc., Los Angeles. Special attention has been given to provision of ample support to withstand the extra torsional strains and load shocks of geared power. All castings are normalized to eliminate internal stress and warping, thus providing permanent alignment of bearings and gears.—AVIATION, *January, 1941*

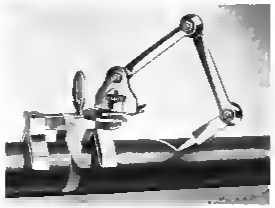
An ingenious nut for fastening sheet metal assemblies, in which the parts must be readily removed and returned to position, is offered by the Elastic Stop Nut Corp., Vauxhall Rd., Union, N. J. The head of the nut is fitted with a vulcanized fiber collar which resists the entrance of the screw, thus automatically taking up all thread play and bringing the load-carrying thread faces of nut and screw into tight-pressure contact. The screw cannot work loose, even under the most severe vibration, but, because of the resilient collar, may be removed and replaced repeatedly without loss of the locking action. These nuts are available in a complete range of sizes, thread systems, shank lengths and materials.—AVIATION, *January, 1941*

Light plane manufacturers will be interested in the new Airlite generator developed by The General Armature Corp., Lock Haven, Pa., and Chicago. Designed especially for operation on light planes under the conditions which confront that particular type, the Airlite generator is furnished for both 6 and

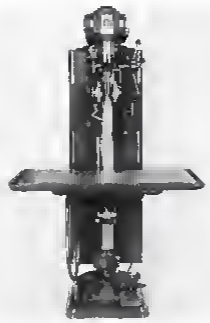
General armature airlite generator



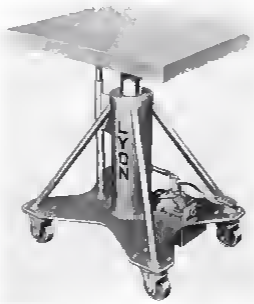
Knu Vise aviation clamp



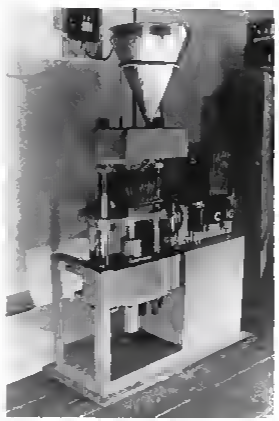
Tru-Line Trumark Junior protractor



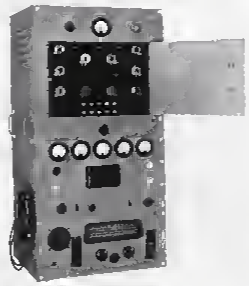
Bakewell precision tapping machine



Lyon hydraulic elevating table

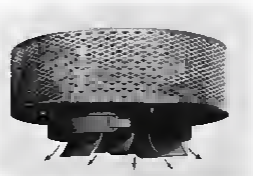


Cropp automatic molding press

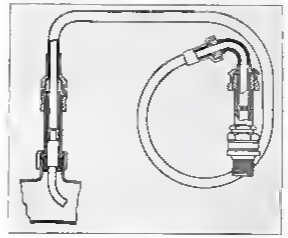


Harvey 100-XEB radio transmitter

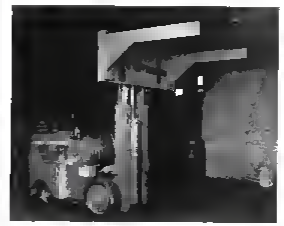
Dayton Rogers Model 'D' die cushion



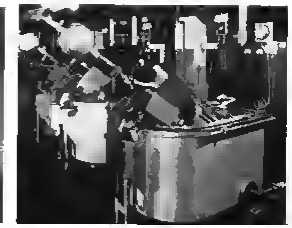
Murray M Series 'Murco" unit heater



Air Shields shielded lead design



Clark Utilitruc



Westinghouse electroplating tanks

L2-ch systems. Comes complete with wiring harness, rheostat control, battery charge indicator switch, junction block, mounting bracket and installation instructions—AVIATION, *January, 1941*

Designed especially for aircraft work a midget toggle plier which, in overall length of but 3 in. and weighing only 3 oz. is being supplied by Knu-Vise Inc., Detroit, Mich. Made from hardened and tempered steel, the Knu Vise develops a pressure ratio of more than 90 to 1 times the pressure applied by the operator, thus enabling rapid and positive clamping of sheet materials and small parts. An adjustment screw may be set quickly by hand for various clamping operations—AVIATION, *January, 1941*

Instant accurate layouts on tubing, rod, flat surfaces or rectangular shapes are obtained by aircraft production men with the new Trumark Junior protractor, made by Tru-Line Corp., Los Angeles, Calif. This instrument marks any desired angle for cutting, shearing, sawing or machining. It eliminates the use of many templates, wrap-arounds and engineering calculations. By use of the plumb indicator any degree of angle from a horizontal plane is instantly determined. This also serves as a master level. The instrument is so designed that any desired angle of mark may be scribed clear around a tube, or a "T" or angle shape.—AVIATION, *January, 1941*

Developed especially to meet the need of Southern California aircraft builders for a high-speed precision tapping machine, the Bakewell Precision tapper manufactured by the Bakewell Mfg. Co., Los Angeles, Calif., is winning wide favor throughout the industry. While in this models it is claimed the Bakewell tapper will cut perfect threads in aluminum, bronze, die castings, plastics, nickel steel, stainless steel, and chrome molybdenum alloys with tensile strength up to 180,000 lb. per sq. in. The first thread is just as perfect as the fifth thread because the tap is used as a cutting medium only and is not used to govern the lead. The tap is driven at 900 r.p.m. and is reversed at 1800 r.p.m. to remove the tool quickly from the work. A special slip clutch prevents the work from being damaged if trouble develops in the hole being tapped.—AVIATION, *January, 1941*

Great use should be found in the industry for the Lyon hydraulic elevating table made by the century-old Lyon Iron Works, 590 Madison St., Greene, N. Y. Not only is it just the thing for lifting, transferring or supporting heavy materials, dies or overhanging work, but it makes a handy adjustable and portable workbench to bring work to proper height for the operator. The base, carriage or leg clearance is the same size as the table allowing it to be pushed up close to a machine, and the table cannot swivel as related to the base, thus avoiding accidents to operator, table or work. Capacity — 2,000 lb.; size table — 24x30 in.; lowered height — 28 in.; elevation — 14 in.—AVIATION, *January, 1941*.

An unusual machine for making aviation small parts, featuring complete elimination of direct labor, is the Cropp automatic molding press brought out by Cropp Engineering Division of Warren Lamp Co., Warren, Pa. Once operations have been timed the press repeats each operation to the split second hour after hour. Because of its robot-like efficiency a single operator can mold as many as twelve different articles with a total production of about 700 pieces per hr. Even the night watchman can supervise a half-dozen of these presses!—AVIATION, *January, 1941*

Harvey Radio Laboratories, Inc., 447 Concord Ave., Cambridge, Mass., have built radio transmitter the 100 XEB. An integral part of each transmitter is a special NC 44 receiver covering frequencies from 540 to 30,000 kilocycles in four ranges. Transmitter and receiver are housed in a cabinet constructed of duraluminum, measuring approximately 21x24x48 in. high. Cabinet and panels are finished in baked gray crystalline enamel.—AVIATION, *January, 1941*

Of particular interest to aircraft production men due to the rapid increase in punch press operations as aircraft manufacturing methods approach mass production, the Davion Rogers Model "D" universal pneumatic die cushion is now made in seven sizes ranging from 6 to 14 in. and features many refinements. Manufactured by The Davion Rogers Mfg. Co., 2830 South 13th Ave., Minneapolis, Minn., the new die cushion is supplied with a combination reducing regulating control valve and pressure gage.—AVIATION, *January, 1941*

When the north wind blows, there'll be cold drafts sending the shivers through many factories, offices and airport restaurants unless adequate "heatening" precautions are taken. A good, simple way to blanket wintry chills is to use the 'Murco' unit heaters announced by the D. J. Murray Mfg. Co., Wausau, Wis. Offered in eleven different models to meet various requirements, the M Series 'Murco' vertical projection type unit heaters are just the thing for buildings with high ceilings and wide areas to heat.—AVIATION, *January, 1941*

A new contribution to the solution of ignition harness troubles is offered by Air Shields, Inc., of Hatboro, Pa. An adapter and shielded cable have been designed to exclude all air space and thus eliminate any tendency toward condensation. Adapters and shielded cable kits are furnished complete, ready for installation.—AVIATION, *January, 1941*

A lifting, carrying, tiering fork truck that will handle loads as heavy as 7,000 lb. and tier them 18 ft. high is now offered by the Clark Tractrator Division of Clark Equipment Co., Battle Creek, Mich., under the name "Utilitruc". Lockheed, Wright Aeronautical and a number of other aircraft firms already have these trucks in service. They are especially valuable in handling boxed engines, installing engines in wing nacelle mountings and performing other odd jobs along the final assembly lines on large aircraft construction. Machine is powered with a 6 cyl. tractor type motor, travels from one to seven mph., climbs steep ramps under load, has rear wheel steering and hydraulic brakes.—AVIATION, *January, 1941*.

That extra "margin of safety," so vital in aircraft, is furthered by dependable wiring systems. The special Deltabeston aircraft wire by General Electric Materials & Supply Div., Bridgeport, Conn., has been designed to carry power to any part of the plane with the greatest possible safety. Deltabeston is flameproof, impervious to oil and moisture and small in diameter.—AVIATION, *January, 1941*.

High speed electroplating is now being done at a temperature of 180 deg. F., in the plant of the Westinghouse Electric & Mfg. Co., Newark, N. J., through the aid of Triflex "K" rubber tank lining developed by the B. F. Goodrich Co., of Akron, Ohio. Triflex "K" lining has been developed especially for such service. It is non-contaminating and completely resistant to the corrosive effects of plating solutions, showing no tendency to throw the delicate plating baths off balance.—AVIATION, *January, 1941*

THE Aviation NEWS

SLAINE STUBBLEFIELD, Washington | C. F. McReynolds, Pacific Coast | Jay P. AuWerter, New York | E. R. Lockin, New York | JANUARY 1941

British Say American Airplanes Under-gunned Admit New Production Will Equal Empire's Best

Washington. (AVIATION BUREAU) To criticisms from British sources that American pursuit planes aren't in the running with the hot stuff fighting over Britain, the only official answer from the War Department is that the charges are only true as regards the older U. S. planes—ships comparable to the Air Corps' Republic P-35 or Curtiss P-36, good ships in their day but two or three years out of date.

Many also were ships designed for the Air Corps but rejected in competition with others.

There is no question but that nearly all the U. S. ships with which the British have had experience are old designs. It was only last Spring that the Administration decided to release late models for export. And it was nearly three months after that before the British placed any substantial orders for these models. The Allies bought obsolescent ships, knowing what they were, because they desperately needed anything that could fly.

A trickle of Curtiss P-40s is probably beginning to arrive abroad—and these are the first models, with the lower-powered Allison engine, the later P-40D is just getting into production. No Bell Airacobras are yet abroad, though some are on the way. Except for a few prototypes, Lockheed's two-Allison P-38 is not yet in the air. Republic has only been in production a month or so with its juiced-up version of the P-35 and is already tooling up for a much better job, the P-44. North American's new pursuit ship has not yet been flight tested.

These new ships, the War Department says, will be the equal of any in the world. The meager known facts about them indicate that they meet some of the current criticisms—they armor the pilot, they have leak-proof tanks, some mount cannon, the two-seater jobs are said to have powered gun turrets. Whether instruments and controls have been simplified to the extent the British think desirable is problematic.

But the crux of the question is fire-power. The British get the jump on the world this year—Germans as well as Americans—by immensely stepping up the fire-power of their pursuit. They mounted as many as eight machine guns. They installed cannon to throw shells and wreck the bombers which have been getting so durable that bullets will hardly bring them down. They introduced the powered gun turret last Spring and wrought havoc among the Messerschmitts.

The British are now convinced that fire-power is everything. Reportedly their next

(*Turn to page 79*)

THE FIRST STEP which will permit mass production of warplanes at Glenn L. Martin's Middle River plant, where 400,000 sq. ft. of space are being added.

Wide World

WITH THE LATEST FEATURES demanded in modern combat, the Martin B-26 bomber is said to be faster than most pursuit planes. Power turrets, self-sealing tanks, protective armor and rear tail turret embodied in this midwing monoplane contradict recent newspaper criticism of American fighting planes. Turrets and nose section are of PLEXIGLAS, to increase gunner's and bombardier's vision.

Rudy Arnold

REPRESENTING $2,000,000 worth of fighting planes on the roof, these 20 twin-engined bombers at Floyd Bennett Field are awaiting shipment to England. With the California factories making flight-deliveries at increased speed, this huge accumulation of planes must remain outside the export hangars until mechanics are ready for them. The airplanes with the single tails and tricycle landing gear are the new Douglas DB-7A bombers, while the others are the famous Lockheed "Hudsons". One "Ladestar" transport in the lower center of the picture, is for South African airline use.

1935 CPT Pilots Go to Army; 701 to Navy
40,000 More Complete Training by June, 1941

CPTP already has fed more than 2600 of its trainees to Army and Navy air training centers, Department of Commerce Secretary Jesse Jones announced Dec. 1. Army schools drew 1935 of the civilian volunteer pilots, while the Navy took 701. More than 55 percent of students completing the secondary course already have been accepted by the Army or Navy, while more than 2000 students of preliminary courses have been taken by the Services without taking secondary.

Mr. Jones said his figures include only those students now in military training or who have been definitely accepted and await orders. An additional 677 who have applied for military aviation have not yet been accepted, but these are not included in the quoted totals.

The report shows that 518 CPT instructors have left the program to serve the armed forces or elsewhere: 264 went to Army primary schools, 163 to airlines, 63 to Canadian schools, 38 to active military duty. This, Jones said, is more than 40 percent of the CPTP instructor staff. To replenish the staff, CPT is constantly improving and re-rating instructors. More than 15,000 preliminary and 3000 secondary students now in training will finish in February. At that time, 15,000 more preliminary and 5000 more secondary students will start courses, to be completed in June.

Meanwhile, on December 2 and 3 at Kansas City, the National Aviation Training Association was formed "to improve the methods of teaching young America to fly . . . under the Government's sponsorship." The group is open to all fixed-base operators but it mainly consists of CPT contractors.

Behind the aims of the organization as stated in its constitution was an undercurrent of anxiety observed by sojourners, lest the CPT be curtailed or transferred to the Army. This uneasiness was set afoot some weeks ago by erroneous, widespread criticism of the program, which came near moving uninformed congressmen to interfere with CAA's plans.

Aviation is told by the best authorities it can find that some Air Corps officers do want to take over CPT. But the high command does not want to interfere, especially not against the wishes of the President, who is Commander-in-Chief. Even if the Army did wish to take over, it would have no planes, no instructors and no airports to effect the change. Apparently about all it could do would be to tighten its militarization of CPT, might even induct trainees into "suspended enlistment."

200 New and Improved CAA Port Projects

The $40,000,000 appropriated by Congress in October will construct or improve 200 airports selected by the joint Army-Navy-Commerce board, providing the maximum number of completed and usable units possible, according to CAA.

Expenditures will be limited to actual landing facilities only, with no funds allocated for buildings, hangars or other appurtenances. Development is expected to be supplemented and enlarged through coordination with the work of WPA and other Federal agencies, however.

The largest allotment goes to Ft. Wayne, Ind., $631,000, while Red Bank, N. J., is listed for $557,000, White Plains, N. Y., $550,000, and Santa Barbara, Cal., $533,400. Other communities receiving $300,000 or more are Austin, Tex.; Bakersfield, Cal.; Baton Rouge, La.; Columbia, S. C.; Fargo, N. D.; Johnstown, Pa.; Las Vegas, Nev.; Morristown, N. J.; Niagara Falls, N. Y.; Rock Springs, Wyo.; Santa Fe, N. M.; Tulsa, Okla.; Wenatchee, Wash.; West Lebanon, N. H.; and Winslow, Ariz.

A total of $3,000,000 is set aside for airport improvement in Alaska and $1,440,000 to improve existing fields in Hawaii.

Contracts will be let by CAA, which has appointed seven regional managers.

Virginia Pickup Route

Aero Pickup Service Corporation, headed by inventor A. W. Card, has filed application for a pick-up route of 25 towns in Virginia. Mr. Card's "Cabot Aero Pickup" is unlike that used by All-American Aviation in that it catapults the load as the hook takes hold thus, according to Mr. Card, permitting greater weights to be carried. The inventor claims it will put 400 to 1000-pound loads aboard planes with ease. If so, it might have military value. The Cabot pickup, which consists of two masts, suspension line, and catapult, mounted on a truck or trailer, was first tested in 1930. Post Office has tested more than 25 different devices for taking cargo from the ground by airplanes.

NACA's Third Lab Goes to Cleveland

Washington (AVIATION BUREAU)—The aircraft engine laboratory, allocated to Cleveland by National Advisory Committee, cannot be expected to contribute to the present emergency. It will be a year before any units are in operation, two or three years before the plant gets into full stride. NACA's other two laboratories are at Langley Field and Moffett Field, California.

Congress authorized the $8,400,000 engine research plant June 26, 1940. Colonel Lindbergh had made a survey and found the need for engine study equipment seriously lacking.

There are no better engines in the world that we are hurrying to catch up with. The Cleveland plant, like the whole NACA program, is long-range basic science, to make sure that no rival catches us. As pointed out by Dr. George Lewis, NACA's director of research, the magnitude of the country's present and future investments in aircraft does not permit any technical mistakes.

Bids for construction were invited immediately. Cleveland was selected after study of 72 sites offered in 42 cities.

"Big Five" Airlines Make Express Survey

All you have heard about air cargo lately boils down to this: The "big five" airlines, meaning United, TWA, American, Northwest, and Eastern (Pan American is not in it), are engaged in a thorough-going survey to find out how much potential express there is, what rates would produce a given amount where it is, what it is, and what problems would be involved in hauling it.

You can bet that one of their biggest questions is what kind of pick-up and delivery system would be feasible. Should the airlines stick with the Railway Express Agency, which already has a ground system, or try to develop something a bit snappier? Maybe the Post Office, which also has a pickup and delivery of no mean proportions, should start an air parcel post service.

Both of these are considered a bit slow on the ground for air express. If air parcel transport is to render maximum service, it must have pickup and delivery that can go places fast. But to set up such a system all over the U. S. would cost a mint of dough. You'll hear more about the "big five's" investigation staff and it's results.

Meanwhile, United Air Lines, with the dynamic Charley Gradick former Post Office Supt. of Air Mail, in charge, is leading off with air express promotion. This year UAL's express revenue will be $625,000, about one sixth of the air mail revenue, which is $3,800,000.

NICK-NAMED THE "HUMMEL", these Siebel Si202 models established an altitude record for its class of 23,000 ft. The baby plane is used by German youth as a training ship, has a 50 hp engine. Training proceeds from gliders to these to primaries.

SPOT CHECKING

Experimental engines in the works by various builders include two sleeve-valve jobs by different firms; a 42 cylinder multibank engine—six banks of seven with special cooling; an air cooled line engine.

Republic Aviation has arranged a $5,210,000 "bankable contract" financing plan for a plant at Farmingdale. Plant will be used first for production of P-43 now under way but later will be converted to the new P-44 for which Republic has $56,499,000 orders.

Iron grid portable runways are under test by Army for use on soft ground. The French used them.

Glider pilot training is seriously discussed again. Official documents show that Germany trained 67,000 military pilots on gliders, and still is training military pilots in sail planes. One German firm alone is building 500 a month. Opponents answer that fliver planes give about the same results, for slightly greater cost. Germans are short of fuel, they say, and we are not.

Toughness-testing machine, at forest products laboratory, Madison, Wisconsin for testing airplane spruce, is approved by CAA.

Air Reserve Association votes to affiliate with National Aeronautic Association, subject to approval of the President.

Hollow steel propeller production at Curtiss-Wright's Pittsburgh plant is being increased ten-fold. President rate of production is 1000 blades per month.

Air Scouts of America, for boys and girls 14 to 18 between model flying and real flying ages, has been formed in Washington; hopes to expand nationally.

New aviation almanac issued by Naval Observatory, begins Jan. 1, 1941. Greenwich hour angles, declination of the sun moon and planets may be adduced from tables for each day.

Dispersion of fog on airports may be accomplished by spraying liquid solution of sulphur chloride into air over runways, it was revealed by Dr. Sverre Petterson, Norwegian meteorologist at fourth Wright Brothers lecture, Columbia University. The Method was developed by MIT scientists.

Yankee Pickup System

A second air mail pickup system seemed in the offing as Richard du Pont, president of All-American Aviation, prepared to apply for seven routes covering 254 towns in New England and adjacent states of New York, New Jersey and Pennsylvania. As this was written Mr. du Pont was discussing his project with Godfrey L. Cabot, a pioneer in the development of the pickup device. The seven routes would radiate from Boston. Two schedules a day are contemplated. Permission to carry only mail and express is requested but the possibility of passengers is being studied.

Government Seeks Men

To those qualified in aeronautics, the Government offers a wide scope of appointment opportunities.

Instructors, Air Corps Technical School, salaries $2,000 to $3,800 a year. Aeronautical Engineers, salaries $2,600 to $3,800 a year. Aircraft Factory Inspectors and Air Carrier Maintenance Inspectors, $2,900 a year. Inspectors, Aeronautical Engineering Materials, $1,620 to $2,600 a year. Aeronautical Engineering Aids, $1,620 to $2,600 a year. Aeronautical Engineering Draftsmen, $1,620 to $2,600 a year. Junior Aeronautical Engineers, $2,000 a year. Associate Aeronautical Inspectors, $3,200 to $3,500 a year.

Full information as to the requirements for the examinations, and application forms, may be obtained from the Secretary of the Board of U. S. Civil Service Examiners at any first or second-class post office, or from the U. S. Civil Service Commission, Washington, D. C.

Southwest Network

Plans for a network of eight feeder airlines covering Oklahoma, Texas, Kansas, Missouri, Iowa, and Illinois serving 82 cities, were announced by newly-formed Southwest Feeder Airlines. The company is financed by eastern business men. Clinton M. Hester, formerly Administrator of the Civil Aeronautics Authority, now practicing law in Washington, is the firm's attorney. Application has been filed for route certificates.

Private Flyers Worried

The private flyers are getting worried lest they all get grounded if a war happens. They have reason for such

THE WASHINGTON WINDSOCK

By BLAINE STUBBLEFIELD

"Seventy-Five's" Predicted

Mr. Private Flyer, the Government may require you to submit and follow flight plans in much better weather than it does now.

Air traffic problem might become No. 1 in aviation. Government may call for licensing of airports.

Almost nothing is too fantastic for inclusion in aviation's outlook these days. Consider, for instance, two or three hundred thousand soldiers in one-man helicopters with machine guns, grenades, rations, pup tents.

Priority plea for calling out reserve pilots from the airlines was requested by Navy. An airline executive rigged up one. It showed that 25 percent of line pilots might be removed by increasing maximum hours of the remaining 75%. Army had not yet asked for a priority plan. Any increase of hours would toss any accident squarely in the lap of the service that removed line pilots. No action is expected.

When airplane production gets going, number of planes required to maintain and expand airlines will be insignificant, and priorities against the lines may be removed. NAA suggests Army let lines have its transports as reserve for the Air Corps.

Believe it or doubt it, an expert of the U. S. Government inspected all British docks, found slight bomb damage. It's the warehouses that make the big fires. Shipping goes right on; goods on docks are covered with acres of tarpaulins.

Chasing bombers away is not enough, they must be destroyed. British experience shows that AA guns on the ground and light guns on planes can't stop modern bombers. American Air Corps is studying plans for fast interceptor planes carrying two or three cannon, possibly 40 mm or more. Seventy-fives are predicted for eventual plane mounting.

Violence of shell-gun hits on enemy aircraft is pictured by a British pilot reporting a strike on a Nazi plane. He said the ship disintegrated so completely that it disappeared, except for unrecognizable falling pieces. Discount the story all you want to and it's still lively shooting.

International air force to help police the world, under some kind of cooperative international system (don't ever call it a League of Nations) has been mentioned by the British. Every nation will want to sell ships to the world police which will make it a confused outfit. But that won't matter, because the nations will all be disarmed, and the police won't have anybody to fight with.

Tortoise and hare describes surface-vessel patrol of sea as compared with air patrol. Of course an airplane can't do as much damage as a destroyer but it can see vast reaches while the warship is poking over a patch. The British are urging U. S. delivery of long range heavy seaplanes for Atlantic service. This means Martin and Consolidated.

A model draft of a State airport zoning law is being developed by the Civil Aeronautics Administration. Civil airports are intrastate, and the Federal Government can only make suggestions. Only 12 states have zoning laws.

fears It would be a tremendous task for some government agency to keep tabs on everybody who owns a plane, determine why he wants to fly, and where; whether he is taking pictures of defense works, drawing maps of harbors, dropping messages, making signals or receiving them, or what other chicanery you can think of. On account of such devilment the British have stopped private flying completely, and probably the Germans and the Italians have too

The only answer proposed for this possibility is the Civil Air Reserve. A campaign is being conducted by NAA and the Private Flyers Association to have the Government accept the plan It would provide for training that would be useful in defense, partially at government expense.

CAA, Writers, Confer

Publicity departments of CAB and the Administrator met with Aviation Writers Association and air transport men in Washington Dec. 4 and 5 to help them get their federal terminology straight, to explain the CAA set-up since re-organization (which still confuses even some experts) and to discuss some of the important problems confronting the Government in its regulation of aviation

N. Y. Air Terminal First in World

The new airline passenger terminal, first in the world, will open January 6 in Grand Central district, New York, with facilities for five major airlines. The six story building can handle 72 limousine loads of passengers per hour, with complete ticketing and reservation facilities, and has three basement floors for the storage and handling of limousines

Usual Accident Story

Every month there is this sad little story in Aviation about the private pilots who crashed, ruined their planes, killed themselves So many of the CAA reports sound alike—first one on the heap says "Pilot Crashes After Stalling in Steep Turn." No use repeating that over and over, it seems, because the boys just keep on doing it. This time, here are five prevalent causes of accidents, arrived at by CAB in a study of hundreds: (1) rash negligence in maintenance of controls and engine, (2) heedlessly doing acrobatics not under supervised training (3) thoughtlessly flying planes at the limit of their performance near the ground, (4) forgetting minimum safe altitudes—500 feet for land planes, 300 feet for sea planes over water; (5) flying when not in good physical condition, —and if you think that means no liker, it does.

Whereas & Whereas

With several "whereases" and "now therefores," President Roosevelt proclaimed December 17 (Kitty Hawk Day, if you forgot) as Pan American Aviation Day, which was duly celebrated as an aid to the "good neighbor" situation But we forgot that other countries have their Wright brothers too and we got reminded Then up speaks Secretary Hull, who is paid for just that sort of thing, and not only admits our oversight, but names the South American air pioneers Jorge Chavez, Santiago de Cardenas, Juan Bielovucic, Bartolome de Guzmao and Alberto Santos Dumont

Calling Names

"Jesse James" is what the Society of British Aircraft Constructors (by mistake) calls Jesse Jones, head of Commerce Department and RFC

Buddy Twins, NBC announcer, gets a Piper Cub prize in Wings of Destiny program

Gill Rob Wilson, president of NAA, was guest speaker at airplane of the Ninety-Nines women's pilot group at Harrisburg, Penna. Dec. 7-8

Lockheed and Vega employees fought a Hudson bomber presented it to the people of England for Christmas

Brig Gen Martin Scanlon, new air attache to Britain is assigned to Eire in addition will head quarter at both London and Dublin

Glen B. Eastburn, former secretary Seattle Municipal League, succeeds Leonard K Schwartz as manager of the aviation department Los Angeles Chamber of Commerce

Walter Swann, long time United traffic agent at Washington turned out to be a good front man now he's assistant to public relations boss Cy Thompson

Brig Gen. John P. Curry, nominated for promotion to major general is assigned to command the Northwest Air District, Spokane

Henry D Sinempfle, former secretary-treasurer of Lycoming Mfg Co., becomes assistant treasurer of Kellett Autogiro Corp. in full charge of the expanded accounting department

Griffith Brewer, president of Great Britain's Royal Aeronautical Society, was honorary chairman of the Wright Brothers Lecture delivered before the Institute of the Aeronautical Sciences by **Dr Sverre Petterssen,** Norwegian meteorologist on Dec 17th

Donald A. Robison is made v.p. of Caterpillar Tractor Co., in direct all selling and advertising activities His former post of general sales manager is taken over by **Gail B Spain,** former manager of the sales development division

Frank B Hammerly, v.p. of Independent Pneumatic Tool Co. died of a heart attack while inspecting the company's plant at Los Angeles on Nov 27th He was 53 years old

Joseph W. Yowell is in charge of aircraft instrument sales for Manning, Maxwell & Moore Inc. was formerly with Pan American Airways

E W Albrecht is appointed manager of all of the New York ticket offices of United Air Lines

C. C Carlton, president of Automotive Parts & Equipments Manufacturers becomes permanent director of the Automotive Committee for Air Defense.

Paul Keller is made Cleveland district manager of Copperweld Steel Co. in charge of the sale of Arisloy alloy steels **B & A Karr** is appointed metallurgist

Claude E Murray, 30 years with Willard Storage Battery Co., becomes its vice president and general manager succeeding S W Ralph

Paul L Gillan joins Aluminum Industries of Cincinnati, on the automotive and industrial engineering committee on staff to work on parts and castings problems

H Edward Maurille, Jr resigns as v.p. treasurer and director of Monocoupe Aeroplane & Engine Corp

Col. Sumpter Smith resigns as chairman in charge of construction of Washington's National Airport, to serve on active duty as division air officer with the Alabama National Guard

Henry G Riegner, selected advertising assistant for TWA in the line's advertising association with the Beaumont & Hohman agency is located at TWA's Kansas City headquarters

John B Walker and **Harvey Hantsch** are appointed assistants to United Air Lines President Patterson Walker has been regional traffic manager of the line with headquarters at N.Y.C. Hantsch, who has been in the company's publicity department, will be located in San Francisco

W. M. Bartsch, United Air Lines mechanic at the Cheyenne base, receives $250 as winner in line's annual suggestion competition He developed a device which costs 10c but saves valuable man-hours

T C Sullivan, secretary of Vultee Aircraft, is made assistant to the president Before joining company last February he was aviation editor of Wall Street Journal

Capt. George R. Cushing is Delta Air Lines' new Operations Manager. Onetime v.p. and general superintendent of Eastern Air Lines, he has been with Delta since 1936, becoming chief pilot in 1937.

Hats Blown Off

Whether Hollywood or Washington thought up such a superdooper as a "Hemispheric Premiere", would be hard to guess, but it was colossal. National Aeronautic Association cooked up a deal with Metro-Goldwyn-Mayer and gave a big cocktail-dinner-preview treat to the big Who's Whos of the flying machine business and other lines, including a lot of lesser fry. It happened one night (Dec. 17) in the ball room of the Carlton Hotel, and it simply blew everybody's hat off The name of the show is "Flight Command," if you hadn't heard

Chamber's New Office

A permanent West Coast office of the Aeronautical Chamber of Commerce has been opened in Hollywood to serve as headquarters for the West Coast Division of the Chamber's Committee on Public Relations, of which A. M Rochlen, public relations manager of the Douglas Aircraft Co., is chairman

Lockheed Buys Terminal

An agreement for purchase of Union Air Terminal, Burbank, subject to approval of the CAB, has been announced by Robert E Gross, president of Lockheed Aircraft Corp All of the stock of United Airports Co of California, operator of the terminal, will be sold to Lockheed Aircraft Corp

Under terms of the agreement United Air Lines, American Airlines, TWA, and Western Air Express will still have operating privileges at the terminal until such time as these lines move their bases to the new Los Angeles Municipal Airport Arrangements are also provided for continued alternate use of Union Air Terminal for takeoff and landing privileges when weather or other conditions prevent use of the new municipal airport

Lockheed Sets Pace

A Lockheed Lodestar flown by G. T. Baker, president of National Airlines, recently set a transcontinental record of 9 hr. 29½ min. Another Lodestar, recently delivered to South African Airways, broke all African records with a flight of 813 miles from Cape Town to Pretoria, in 3 hr. 4 min., an average speed of 265 m.p.h. Another South African Lodestar flew from Pretoria to Nairobi, 2,000 miles, in 10½ hr., the first time this route had been covered in one day

Extend Training Schools

Worried that pilot training may not keep pace with accelerated aircraft production, the War Department is planning wide extension of training facilities through use of additional civilian schools, establishment of new ones, and creation of several more military training centers

Survey boards have been busy in the field looking over sites preparatory to expanding the program in time to get new schools underway by spring Officials still hope to increase the turnout of military pilots from 7,000 to 12,000 annually by June 30, 1941, although there is some doubt that this goal can be reached

The Army is now using 18 certified civilian schools and 11 Army centers, including the 3 Air Corps training bases, but only 8 of the military flight locations are yet in operation. When the new facilities become active, it is estimated some 24,000 students must be "processed" to graduate 12,000 flying cadets

Aircraft Instrument Co.

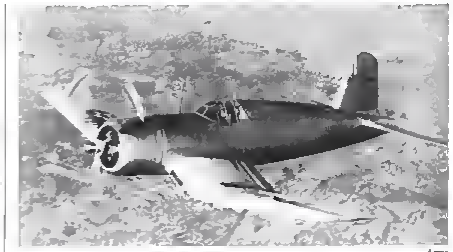
Formation of the Aircraft Instrument Co in Los Angeles to manufacture a turn, bank, and position indicator for aircraft developed by Major W K. Burgess, March Field, has been announced by Major Frank E Benedict, president and general manager

Boston Blimp Base

Capt Charles E Rosendahl, U S N., while on a lighter-than-air base selection tour of New England said that the Navy plans a $5,000,000 airship base in the vicinity of Boston, with auxiliary stations near Portsmouth, N H., and Newport, R. I The Boston base will cover 640 acres and house a force of about 300 men. The blimps he explained, would be useful for inshore spotting of submarines that had slipped past the neutrality patrol Proposed base in Florida seems to have been abandoned Lakehurst and Boston will serve the Atlantic coast for the present.

HIGH ALTITUDE FIGHTING is what the Republic YF-43 pursuit is designed for. This heavily armed plane has a supercharged engine with secret Republic installation calculated to give it unexcelled efficiency at sub-stratosphere heights. Fully retractable landing gear is entirely flush riveted.

THE FASTEST CLIMBING PLANE in the world is claimed by Curtiss-Wright for their new 21B interceptor-fighter, which can do one vertical mile in 60 seconds With a guaranteed speed of 333 mph., this all metal monoplane can take off from practically a standing start with full power.



Acme

THE NAVY'S NEWEST fighting plane, the Vought-Sikorsky XF4U-1 in flight

Gas Export Control

The Defense Commission states that the greatest problem of export control of aviation fuels has been the defining of those fuels to be placed under restriction The Presidential Decree of July 26, 1940 places export limitations on fuels of 87 octane or over This limit conserved the high test aviation gasoline for this country and was not too severe to the petroleum export industry The issuance of a proclamation shortly after the Presidential decree permitted export of high test fuels only if destined for the Western Hemisphere, the British Empire or American-owned companies or concessions in other countries

(Continued from page 75)

models will mount twelve guns or four cannon U S. designers have not gone anything like as far. No production U S ship has more than one cannon, though a three-cannon ship is supposed to be in progress on the drafting board.

There are two sides to the argument. A pursuit plane basically is a gun platform, and the gun is all-important. On the other hand, when you load on more iron you inevitably cut down flying performance The line has to be drawn somewhere, and equally competent experts will draw it at different places That Americans plump for performance fits in with the general tenor of U S. tactical thinking, which, for instance, sticks to aimed fire as against European field-of-fire theories

The current wave of public criticism of American ships is very likely an effort to build a fire under the Air Corps The British, of course, have made no official complaints, but when the recognized head of British labor talks to the American press, His Majesty's government can be presumed to know what is being said

The British recently have been uncertain whether they can get the most help from the U S by talking up their strength or their weakness. Their uncertainty about American planes is apparently linked with this general confusion Representatives of the British in Washington told *Aviation* that Americans too often take the remarks of British citizens as British policy

Lord Beaverbrook, British Minister of Aircraft Production, modified the criticism by saying the P-40 is a good straightforward job, flying easily and having a reliable engine But the complaint that current deliveries are underarmed apparently still stands

Navy Anti-Air Defense

The Navy is asking $300,000,000 from Congress to supplement the anti-aircraft armament of its ships The action is taken as a result of lessons learned from the European war, and in Navy's own maneuvers Splinter shields for gun crews, more heavy anti-aircraft guns, many more pompoms, and greater storage space for ammunition are believed planned Fleets must be prepared to stave off almost constant attacks by aircraft.

Plane Priorities Against Airlines Relaxed Status Quo Plus Some Expansion is Expected

Re-instatement of at least 50 percent of the airlines' orders for equipment seemed probable as this was written. The Priorities Board of the National Defense Commission had "frozen" deliveries to the airlines pending study of engine needs for the Air Corps and for Britain. Specifically, the Board had asked Douglas and Lockheed to withhold 60 two-engine transports each, on order to the airlines. Pratt & Whitney was directed to hold up the corresponding engines. At the same time the Army went after a number of finished engines which the airlines had obtained in advance of need and were holding in crates for replacements. Thirty-four were obtained from TWA and negotiations were instituted to get 14 others from American Airlines.

For the future, the Board hints that it may be able to work out a limited amount of equipment expansion during 1941. And although not officially admitted, it is understood that Pan-American and American Export will have no difficulty in getting planes for their South American service, export sales to South American lines now mostly using German equipment will doubtless also be permitted.

The industry is convinced that the Army will soon find it doesn't actually gain much by stopping civil production. The planes now being diverted can of course be used as Army transports. The extra engines although basically the same as power plants now going into bombers, differ considerably in detail; what they will be used for is problematical. Whether combat plane output will be increased significantly remains to be seen. There is a feeling in the industry that in the whole affair, the Army has simply been building up an alibi for slow procurement of military aircraft assertedly resulting from finicky buying procedures.

Meanwhile, the N.A.A. was pushing as a possible compromise a plan by which the lines would buy transports to the specifications of Army transports (the chief difference is a higher seating capacity) and agree to turn them over on demand.

Light plane builders, in the meantime, are shivering and wondering when the lightning will hit them. They feel fairly safe so long as the Civil Pilot Training Program is considered as having defense value. In Washington, they get informal assurances that they will not be left out in the cold. But they are keeping a leary eye on the Army and are giving some thought to possible substitutes for aluminum sheet, of which they use about a million pounds a year. But they don't know how they're going to find a substitute for engines if the Priorities Board should decide that manufacture of light power plants interferes with output of trainer engines.

Auto Builders To Take Plane Sub Contracts

Washington (AVIATION BUREAU) The Detroit auto builders will not enter the aircraft industry as prime contractors. The plane parts they are getting ready to manufacture will be built under sub-contracts from existing aircraft firms. However, the plane firms will not be acting in their present capacity as independent firms but as contract operators of government owned assembly plants.

That is the present intention. Whether it is adhered to depends upon many factors, chief among which is the progress of negotiations for construction and operation of assembly plants. Detailed decisions as to the plants have not yet been reached. Probably a number of unit plants with a capacity of 100 two engine bombers a month will be built, plus some plants for heavy bombers. They will be located in the mid-west, near but not in the Detroit area. The neighborhoods of Omaha, Kansas City, and Tulsa are being considered.

So far Glenn Martin and North American have been most prominently mentioned as possible plant operators. Others will probably be brought in; Consolidated, for one, is almost sure to be included.

These plants will be government financed and government-owned, like some of the powder mills and tank factories now being built. Aircraft firms will be hired to operate them on a fee basis. They will be given contracts for airplanes and in turn will subcontract with Detroit for parts and sub assemblies. The new plants will be purely for final assembly.

Chances are that none of these plants will be put under contract until Congress has had an opportunity to appropriate money. There are funds now available which could be used, but they are wanted for other projects and, in any case, it is thought there won't be any parts to assemble till sometime next year.

Unions Eye Industry

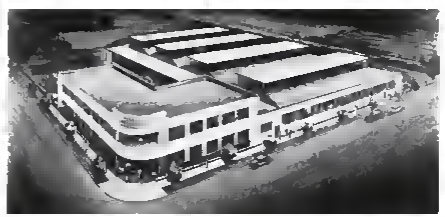
That the first major strike in a defense plant was directed against an airplane manufacturer—Vultee—was significant. The whole question of labor's position in armament production is a hot one, and the aircraft industry is in the hottest spot. It is probably the least throughly unionized of the war industries, a strong drive is underway to organize it.

CIO's Auto Workers, which considers that it won at least a partial victory in the Vultee strike, has announced its intention of organizing the entire industry. Its first campaign is aimed at Douglas. Meanwhile, the AFL's machinist union, which has just entrenched itself at Boeing, is preparing to expand.

Inevitably this push is going to result in some work stoppages. What the government attitude is going to be is by no means clear. Initial effort will certainly be to stave off a final showdown; there will be pressure on unions to submit to arbitration; there will be pressure on employers to grant some wage increases and to submit to organization of their plants.

In the cards for early action is formation of a special committee of industry, labor, and government representatives to devote itself to maintaining labor peace in aircraft—similar to the committee that is already set up in the shipbuilding industry.

Sooner or later, however, some stubborn dispute is going to prove itself not amenable to the methods of conciliation and extra-legal government pressure, and Congress will have to thrash out a policy. The President has indicated that though he is against restrictive legislation now he may not always be. Final compromise may well be something like the railway labor act, providing for a compulsory waiting period, a review of the situation and recommendations by an impartial board, with theoretical maintenance of the right to strike afterwards.



PRODUCTION IS EXPECTED TO TRIPLE in this new plant of the Aircraft Associates Corp. at Burbank, Calif. 46,000 sq. ft. will be contained in the new building. Current backlog of the company is $1,600,000, and personnel will be expanded 50 per cent by the first of the year.

No Trade Involved In British Bomber Deal

The British got their Flying Fortresses as the year ended, but the "trade" for engines which was advanced as a justification was somewhat misleading. There had been political pressure for some months to send them some of the Air Corps' four-engine B-17's, but it turned out the British didn't want them, were holding out for the later model of the Boeing B-17 which was faster and mounted powered gun turrets. It came into production in November. British also wanted the similiar Consolidated B-24, on which deliveries are about to start.

As is now usual with fighting planes, it was decided to give the British first crack at the big ships—deferring delivery on U.S. orders.

Meanwhile another problem

had arisen. Under the law giving priority to U.S. military orders, the determination of what equipment goes abroad is essentially one of allocation. It was found that too many of the 1,200-hp Wright engines had been assigned to Britain—so many that some 41 of the B-17s were without engines. The allocation had to be changed.

Because Flying Fortresses for Britain had become a political issue, it looked like a good idea to tie the two moves together into a trade.

Aircraft Industry Doubles in One Year

Productive plants in the aircraft industry nearly doubled during 1940, rising from about 12,000,000 sq.ft. at the beginning of the year to 22,500,000 at the end. Now under construction is an additional 22,600,000 sq.ft. most of which will be complete by June. Cost of the plants already completed is reported by the Aeronautical Chamber of Commerce as $83,400,000. An additional $232,200,000 will be spent to complete the program.

Employment, which totaled 80,000 at the beginning of 1940, is now 165,000 and will reach 382,000 by June.

Airplane plants have a floorspace of 12,700,000 sq.ft. compared to 7,400,000 a year ago, and an additional 18,000,000 ft is under construction.

Engine floorspace totals 5,300,000, was 2,200,000 a year ago, and 4,400,000 more is scheduled.

Propellor and accessory plant amounts to 4,800,000, was 2,400,000 at the beginning of the year, and is scheduled to reach 8,800,000 sq.ft.

Nationalize Production?

Washington (AVIATION BUREAU)—Nationalization of aircraft production, currently worrying some heavy thinkers, is largely a matter of terminology. In a sense it is already here, plane builders build what, where, and how they're told to from Washington. In the sense of government ownership of plant it is inevitable in the next few years. The new assembly plants to be built in the midwest in connection with auto-plant parts manufacture apparently will be government-owned—like the powder mills and tank factories. But even the expansions being carried out by the private aircraft manufacturers are largely being financed by the so-called "bankable contract." Under this plan, the plants become the property of the government in five years unless the private operator decides to buy them back. If the emergency is then over and the airplane industry has shrunk to pre-war size few plants will be bought. Thus, by far the largest part of the industry will be government-owned.

There is no evidence at present, however, of any interest in government operation of manufacturing plants. Indeed the long-existent Naval Aircraft Factory is not being notably expanded. Private firms run the plants, either as owners subject to an ever-increasing mortgage under bankable contracts or perhaps, in the new assembly plants, as agents of the government. How a post-war administration would feel about this remains to be seen.

Assembly Lines

Ultra-fussy inspection by Army and Navy procurement officers may slack off under pressure of mass production, industry complaints, and shortage of skilled inspectors. Defense Commission officials are asking for simpler and less frequent inspections and believe they find a receptive attitude in the services. They argue it's fine to X-ray every piece on a civil transport, but that if you want to build a thousand fighters you have to inspect on a sampling basis or you'll gum up production.

Army's drive to corral transport production is based on its sudden realization of the value of parachute troops. Desultory experiments began about a year ago, but only in the last few months has a drive started to organize such troops. Not only do parachute troops have to be delivered in transports, but parachutists are most usefully employed to seize airports and permit mass aerial delivery of troops. This takes lots of planes. Big orders for transports have already been placed with Douglas, and with Curtiss at St. Louis.

North American is now in production on its medium bomber, the B-25—a five-man craft with retractable tricyle landing gear—and it is being tested by the Air Corps.

Cannon fire of the Bell P-39, the Airacobra pursuit ship, has been found satisfactory in Air Corps tests. The P-39 mounts a 37-mm cannon (firing shells instead of bullets) in the propellor hub and machine guns firing through the prop. About 500 rounds of shells were fired over a period of a week, with the cannon standing up and maintaining its accuracy. Procedure was to load up the plane, fly to a target 15 minutes away, fire all ammunition, and return, repeating about seven times a day.

Lockheed expects to be in production by spring, in the plants of its Vega subsidiary, with an improved version of the Hudson bomber. The new ship will be a military variant of the Lodestar transport, with 1,800-hp Wright engines instead of the 1,200 hp. jobs in the commercial ship.

A new radio receiver for light planes that weighs only 2 lb and 12 oz has been developed by the Electronic Specialty Co., Glendale, Calif. Carrying the trade name "Ranger", the new receiver is said to be the only low-priced aircraft set built under American Telephone & Telegraph patents.

Another medium bomber, Martin's B-26, has also reached the testing stage. It has tricycle landing gear, two 1,850-hp P & W and four-bladed full-feathering propellors 13½ ft in diameter. The B-26 is credited by the Air Corps with being faster than many pursuit ships and has been described as the fastest bomber ever built.

Consolidated expects to complete delivery by February on its order for six 25-ton four-engine patrol bombers, PB2Y-1; first of these were turned over to the Navy last fall.

A plastic-bonded molded plywood primary trainer is being worked up by Doak Aircraft, of Hermosa Beach, Cal. President E. R. Doak was formerly with Douglas. The Doak plane, weighing 2,500 lbs., mounts a 225-hp engine.

The Timm Aircraft Corp, Van Nuys, Calif., reports receipt of an order from Vultee Aircraft of approximately one million dollars for airplane parts and accessories. This brings the backlog of Timm parts business to well above $1,000,000. The present staff is to be increased.

Consolidated expects to complete by June a $7,000,000 plant for manufacture of parts and sub-assemblies which, comprising 1,553,000 sq.ft., will nearly double the plant now in operation or nearing completion. When the eight buildings of the new parts plant are in operation Consolidated will be employing 30,000 men.

Two of the smaller engine firms have arranged with the government to finance new plant by means of the "bankable contract" under which the government owns the plant in five years. Lycoming will spend $1,597,000 on its Williamsport, Pa., plant, while Fairchild will con-

CESSNA AIRCRAFT CO. in Wichita has just completed this new assembly building. Left line here is for single-engined ships, while twin-engined planes such as have been bought by the Army for trainers, are on the right.

TO AUGMENT FLYING FORTRESS PRODUCTION Boeing is building this new plant for their Stearman Aircraft Division at Witicha, Kansas. Measuring 330 x 1,000 feet it will be a complete new plant separate from the existing plant at Wichita. It will make the total floor area of the Boeing Seattle and Wichita plants more than 3,000,000 square feet.

MASS CYLINDER PRODUCTION is the theme of these nitriding furnaces at the Wright Aeronautical plant, Paterson, N. J. Rails provide the transportation, the work being loaded in three receptacles and the furnace moving from one group to the next when the nitriding is completed. This is but one of the many new nitriding furnaces at Wright.

struct a new plant and an addition to its present structures at Hagerstown, Md.

Edo Aircraft is also using the bankable contract to finance a 47,000 sq.ft. expansion at College Point, Long Island, at a cost of $365,000. Most of the new space will be used to build seaplane floats.

Menasco is increasing by 50 percent its new plant at Burbank, Cal., using the addition for manufacture of hydraulic landing gear struts.

Incorporating an automatic regulating device to correct for variations in air density, a true air-speed indicator is reported to have been perfected by L. N. Schwein, San Marino, Calif. The device has undergone extended flight testing and will be placed in production shortly according to present plans.

A new factory building more than doubling the size of present facilities, is being erected by the Leach Relay Co., Los Angeles, manufacturers of electrical equipment designed especially for aircraft.

October deliveries of Adel Precision Products Corp., Burbank, Calif., were $85,000, highest in the history of the company. Gross sales for the first six months of the fiscal year, to Nov. 1, aggregated $318,000, and current deliveries are continuing at a rate in excess of $1,000,000 per year. The new factory in North Hollywood was to be ready for occupancy by Dec. 1, providing facilities for further expansion of production on the company's line of hydraulic equipment and aircraft accessories.

Largest plant expansion announced recently is the government-financed program of United Aircraft, totalling $18,161,000. This includes $14,799,000 for addition of 434,000 sq ft. to the Pratt & Whitney engine plant at East Hartford. The Vought-Sikorsky Aircraft Division at Stratford, Conn., will be expanded by 258,000 ft. at a cost of $1,600,000. And an additional 49,000 sq.ft. for the Hamilton Standard Propellor Division will cost $1,761,000.

Purchase of Paramount Aircraft Products by Felt & Co. and Allen & Co., is the first step in organization of a new parts manufacturing firm which will involve acquisition of several other companies.

With more than 300 employees now on the payroll, and a backlog of aircraft parts orders exceeding $1,635,892, the United Aircraft Products, Inc., Los Angeles, is materially expanding production facilities and adding to personnel. Additional orders for $700,000 of aircraft parts machine work was received in October and further substantial business was in prospect.

In line with recent plant expansions in the East by Air Associates, Inc., a new $200,000 factory is to be erected at once on a 10-acre tract of land adjoining Los Angeles Municipal Airport, according to Ray Acre, vice president in charge of West Coast operations. Floor area of the new plant will cover 80,000 sq.ft. and will be divided evenly between manufacturing and warehouse facilities.

Aviation Problems Before Incoming Congress

Funds for new aircraft—estimated now at a 20,000 plane minimum—will be speedily approved without controversy by next Congress. Chief among other subjects already evident as of major concern are:

(1) Modification or repeal of the neutrality and Johnson acts to increase aid to Britain, with administration approval.

(2) Investigation of the progress of the defense program authorized at the past session, centering around the Wheeler Committee. Wheeler will probe licensing agreements, patent pools, prices and other matters related to defense contracts.

(3) Heated debate on the problem of labor relations in defense industries is expected. Sidney Hillman will urge arbitration, through individual labor - management - government industry committees, but there will be pressure on Congress for some form of "no-strike" law. In the aircraft industry, the chief stumbling block in formation of a labor relations committee has been the problem of arranging adequate representation for that portion of aircraft employees—63 per cent—who are not affiliated with either CIO or AFL. Positive developments in labor relations are anticipated for aircraft and ship building because these are most critical to the British.

(4) Enactment of another and more rigid tax law, tapping new sources of revenue in the hope of financing the greater part of the year's cost of Federal non-defense activities.

IAEC Outlook

Outlook of Interstate Aircraft & Engineering Corp. is reflected by current employment of 400 persons, against 125 a year ago. Backlog on Dec 1, 1940 was more than $1,000,000, including $400,000 for hydraulic components. Don P. Smith, president announced that quantity production is now under way on his firm's new Cadet training plane, with twenty planes scheduled for delivery during the month of December, and production geared to reach an output of 900 planes during 1941.

Romec Pump's Backlog

With a $300,000 backlog, Romec Pump Co. of Elyria, Ohio, is building a new factory to handle the increased demand for non-pulsating aircraft fuel pumps. The company also provides aircraft manufacturers and transport companies with complete engineering consultation service on all fueling problems as an aid in speeding up the aviation program.

Army Orders Nylon 'Chutes

In an order for 7,800 parachutes, which the Army has given Switlik Parachute Co., 200 are to be made of Nylon. 100 of these are to be made up in seat packs and 100 in back packs.

Switlik built their first Nylon 'chutes about four years ago and since then have developed improvements that lead them to believe this material can eventually be substituted for silk. All the tape threads and lines will also be made of Nylon. These have been tested and proven satisfactory.

So far this year Switlik has delivered or has on order 25,000 parachutes.

Recent Awards

War Department

Bendix Aviation Corp., Bendix, N. J. $802,474 for assemblies and maintenance parts.

Republic Aviation Corp., Farmingdale N. Y. $103,664 for maintenance parts.

The H. Cole Co. Columbus Ohio $112,000 for compasses.

Boeing Aircraft Co., Seattle, Washington. $246,015 for fuel tanks.

Scovill Mfg. Co., Waterbury Conn. $4,231,240 for ammunition components.

United Aircraft Corp. East Hartford Conn. $1,476,816 for maintenance parts.

Bendix Aviation Corp., South Bend, Indiana, $280,150 for wheel and brake assemblies.

Square D Company Elmhurst N. Y. $645,005 for indicator and tube assemblies.

Kollsman Instrument Div., Square D Co. Elmhurst N. Y. $104,318 for tachometers.

Navy Department

Sperry Gyroscope Co., Inc., Brooklyn N. Y. $355,863 for gyro compass equipment.

Curtiss-Wright Corp., Buffalo N. Y. $28,136,783 for airplanes.

Consolidated Aircraft Corp., San Diego Calif. $18,528,506 for airplanes.

Sperry Gyroscope Co. Inc. Brooklyn N. Y. $6,644,487 for automatic pilots.

United Aircraft Corp., East Hartford Conn. $27,838,179 for airplane engines.

On Schedule

By "Vista"

Further expansion by American Export Airline's new acquisition, TACA, was presaged by a recent flight from Guatemala City to New Orleans by Lowell Yerex in a Lockheed 14, and a series of survey flights which were started with Export's flying boat over a route from New Orleans to Cristobal, via Belize, British Honduras. This route, when inaugurated for regular service, would offer the first direct services from Central America to the Southern States, where fast and convenient connections would be available to all points north, east and west. It is proposed to run these services both from Guatemala City and Belize to New Orleans, with other flights to the Canal Zone and possibly Latin America.

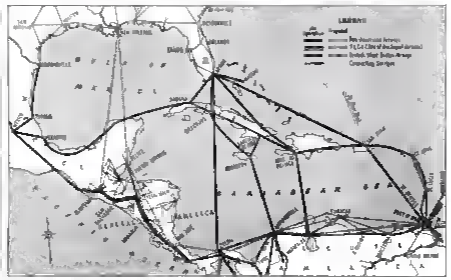
Unconfirmed news also indicated that the TACA very probably will shortly expand her sphere of operations along the North coast of Latin America via Colombia and Venezuela to Trinidad. These services will parallel Pan American's to a great extent, so that competition will not only enter this company's Atlantic services, but also the routes in Latin America, which to date were more or less PAA's private domain.

All this indicates that a battle for preference in air traffic in the Central and Latin American countries is developing between Pan American and Export Airlines, with in addition American Airlines joining in with an attempt to open services to Mexico City through a newly formed subsidiary.

In Trinidad, Lowell Yerex has organized a new airline, upon instigation of the local government, which will operate services between Port of Spain, Barbados and Tobago with a Lodestar, recently flown there. The Holland KLM, which lost its permission to fly lines via Trinidad in May, was informed that the routes could be reopened around Jan. 1, so that connections will then again be available to other British possessions in the Caribbean. The route to Barbados was originally organized and developed by the KLM. However, with the new permission came a memorandum from the Trinidad Government that no new services between British islands would be allowed to foreign operators, and that therefore a reopening of the Barbados service was impossible. The possibility that such a decision would be forthcoming was already indicated earlier, and naturally holds connection with Yerex's new plans. The new company, to be known as "British West Indian Airways", will eventually connect all English territories in this hemisphere, and may in due time even offer serious competition to American operators in this area.

The many services of the German Lufthansa are said to be operated with planes confiscated in conquered countries, which were mainly American. Lufthansa's "commercial" planes are thereby released for war duties, for which they actually were ready long before the present war started. It was quite common in 1938 to enter the washroom of a Junkers transport, and find complete machine gun mountings and hatch openly installed just above your head.

Status— The plans of Germany to open an airfreight line across the Southern Atlantic reached a stalemate when the Brazilian Government decided that the moment for such expansion was "inopportune". Among the many contenders for Atlantic services now also stands Spain, where plans are being made for a service to Buenos Aires with six Spanish make planes. Spain has been attempting to open such a service since 1922 with dirigibles, but the plans never materialized. With Brazil's refusal to Germany possibility of a Spanish company dominated by Nazi Germany is likely, and new attempts to obtain direct connections between Germany and Latin America through the air will probably be many.



MAP shows the battle for airtransport supremacy now developing in the Caribbean between Pan American and American Export Airlines, with new extensions proposed by both companies. Due to the fact that Lowell Yerex is manager of both Export's TACA Division and the new British West Indian Airways, close cooperation of these two companies is to be expected. Rumored Export line from Panama non-stop to New York is not shown, being too indefinite.

British Combine

THE FRONT GUNNER and bomb aimer in the turret of a Whitney bomber.
It is this type of armament which recently was discussed in artilleam of American warplanes.

Dutch gov

A DUTCH FOKKER T5W float plane (Wright Whirlwind engines) flying down the English coast to take up convoy patrol. Men of the Royal Dutch Naval Air Service have already given a good account of themselves during the invasion of Holland.

FOLLOWING the promotions of William D. Kennedy and Raymond W. Young (Aviation, Dec. 1940), Wright Aeronautical Corp. has appointed W. B. Sirren (l.) and Arthur H. Leak their respective successors as service manager and assistant chief engineer. Mr. Sirren, former supervising service engineer has been with the Curtiss organization since 1917; Mr. Leak, former design engineer, joined Curtiss in 1923.

W. V. C. AUSER (l.), personnel director of Wright Aeronautical Corp. since 1932, takes over the newly created post of personnel director for Curtiss-Wright Corp., supervising the coordination of the personnel policies of the entire organization and all its plants. His successor at Wright is Walter W. Bishop, a test engineer, with Wright Aeronautical for seven years and since 1939 assistant personnel director.

CONTINUING as president of Republic Aircraft Products Corp., William F. Wise takes on added duties of executive vice president of Aviation Manufacturing Co., to which post he has just been appointed.

BRITISH Contract Coordinator is Gardner W. Carr's new title. Lately in charge of production control at Lockheed, he will take over the administration of the company's British contracts.

MANAGER of Curtiss-Wright's new plant being built at Port Columbus, O., is J. A. Williams, former assistant to the vice president and general manager of the Curtiss Aeroplane Division at Buffalo.

NEW PRESIDENT of Romec Pump Co. is Paul E. Ryan, previously with Osborn Mfg. Co., Templar Motors and production executive for U. S. Aluminum. W. L. Davis continues as vice pres.

HARLAN M. ELLIS (l.) has been appointed sales manager of Hamilton Standard Propellers. He has been with the company for the past five years, recently as sales representative on the West Coast. Robert W. Russell (r.) has been assigned new duties as special assistant to the general manager. With the company since 1933, he has been assistant sales manager of Hamilton Standard Propellers since 1937.

UNTIMELY DEATH of Wilbert J. Austin, 64, in the recent airline accident, is a keen loss to the aircraft industry. He was president of The Austin Co., builders of aircraft factories, hangars and terminal facilities.

PRESIDENCY of the Aeronautical Chamber of Commerce is again assumed by Col. John H. Jouett, through his reelection. Other officers are G. L. Martin, L. R. Grumman, Howard Mingos, R. H. Depew Jr., F. J. Walsh.

COL. IRA C. EAKER, formerly executive officer, Office Chief of Air Corps, is now in command of 20th Pursuit Group, Hamilton Field, California, the first pursuit group equipped with new Lockheed interceptors.

FROM the Los Angeles Chamber of Commerce comes Lockheed Aircraft's newly appointed public relations director, Leonard K. Schwartz, who has been manager of the Chamber's aviation department.

THE YALE BOWL, annual award of the Yale Club of Montclair to the graduate "earning his Y in life", went this year to Juan Trippe, PAA's president, for pioneering America's aerial merchant marine.

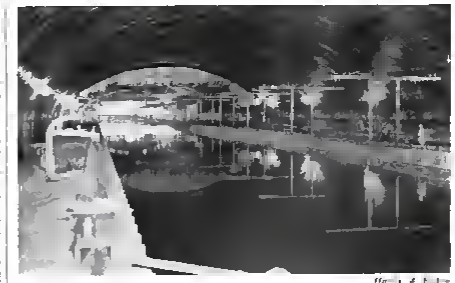
Testing Tower For Parachutes

In a novel attack on the problems of parachute testing, the Pioneer Parachute Co. has erected a testing tower as a means for observing at close range 'chutes in the process of opening. The tower was developed and built by J. Floyd Smith, vice president and chief engineer of the company, and his son, Prevost Smith, aeronautical engineer.

A boom 50 ft. above the ground whirls a dummy around a circle 200 ft. in diameter at speeds varying from 70 to 300 mph. The dummy, on which is fastened a parachute harness and pack, is supported at the end of the boom by flexible streamline rods. A 320 hp. marine engine set up at the base of the tower supplies the power to the boom through a gear train and drive shaft.

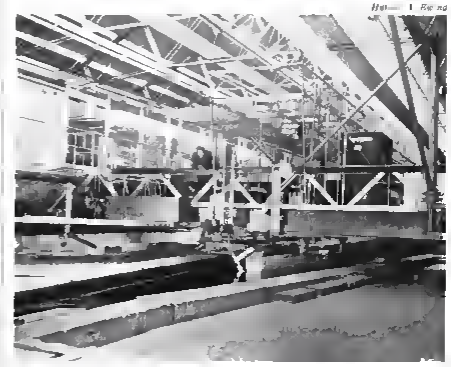
As the boom revolves, the dummy swings up from the ground and, at high speed, travels in the same horizontal plane. A light cable attached to the rip cord enables the operator to release the 'chute at any desired position. Slow motion pictures of the opening process are taken by a high speed camera mounted on a spreader between the flexible streamline rods. The camera is so rigged that it starts functioning when the rip cord is pulled. Excellent slow motion pictures can therefore be taken under properly controlled conditions, so that all details, including the shroud lines, may be clearly seen.

In addition to providing scientific data on parachutes, it is believed other aeronautical test purposes may be carried out on the tower, such as high velocity destruction of airplane parts and examination of pilots under high "G" conditions.



THIS WATER RUNWAY, 963 ft. long 51 ft. wide and 22 ft. deep is one of four in the world's largest naval testing laboratory, at Carderock, Md.

READY TO START a test run, Meet models make several hundred runs before tests are completed. Models are mounted on the movable carriage. (Below)



A FEW OF THE MODEL PLANES stored about the old laboratory at the Navy testing basin on vertical racks.

Dedicated to solution of the problems of air and liquid temperature and pressure control, with particular references to sub stratosphere flight operations, the Aireserach Manufacturing Co., Glendale, Calif., is conducting an intensive research program under direction of W. R. Remsonr, manager of the heat transfer division.

Manufacturing operations of Aireserach already include a complete line of engine oil coolers, intercoolers, aftercoolers, Prestone radiators and cabin pressure and temperature control devices. Included in the facilities provided by recent plant enlargements are a wind tunnel of 230 m.p.h. airspeed, heat exchangers of great capacity, mixing chambers for large volumes of air, a flash steam plant, dry ice super-cold cabinet, and various duct sections which duplicate flight conditions, giving accurate prediction of actual performance of heat transfer products when placed in final use.

Five Little Chores

Five jobs that research can do for aviation were described in replies from 1,042 research directors of leading manufacturing concerns, to a questionnaire by Research Advisory Service, maintained by a bankers' association. (1) A procedure for dispelling fogs locally over airports. (2) Material to which ice would not adhere, for use on airplane wings. (3) Construction improvements, such as flush riveting or spot welding to achieve absolutely smooth surfaces. (4) Light weight, low cost accessories for aircraft engines, such as fuel pumps, ignition, starter, etc. These would bring costs down to meet a large demand. (5) A ship of the "gyration type" to land on roofs or small spaces. Such a ship would relieve dwelling house congestion by scattering population far and wide over the countryside.

Tool Company Activities

Aircraft Tools, Inc., Los Angeles, is now erecting a modern factory building designed exclusively for the manufacturing facilities of manufacture of small tools for the aviation industry. This marks the fourth expansion move of this company and will triple present facilities.

In the opening of a series of articles entitled "It Isn't in the Book," which appeared in the November issue of Aviation, we inadvertently failed to give credit to the author, Frank B. Lane, of Engineering and Research Corp. Mr. Lane wrote the article, "A Diagonally Braced Wing," and supplied the illustrations which appeared on page 60 of the November number.

BLAST ENGINE invented by E. B. Meyers of New York has aroused considerable comment by those who have seen it. It uses the jet propulsion principle and derives its power from an explosive mixture of two liquids.

Pan American Airways Asks Manila-Singapore Route Also Applies for Puerto Rico-New York Certificate

Vastly significant in world politics is Pan American Airways application for a 1700-mile hop from Manila, P I, to Singapore, second largest trading post in the Far East, and mighty base of the British Navy Observers in Washington immediately concluded that the application had been filed in connection with this country's pressure against Japan, and the possible basing of our fleet in Singapore Exploratory trips twice a month will commence when the route is authorized Japan countered at once by stepping up experimental flights on a line from Japan to Formosa to Palau, passing the Philippines and crossing PAA's Guam-Manila leg

Another move significant in the defense picture is PAA's application for a direct connection between New York-Baltimore and Puerto Rico, America's Gibralter of the Panama Canal. Fully equipped bases are already provided This direct, overnight service, which would also shorten the time to South American east coast points, will start in the spring

To accomplish the New York-Puerto Rico run, and to make the big U bend from Portugal down the coast of Africa, across and up the coast of South America, longer-range planes will be made when trade winds are right, if approved by CAB, to avoid Horta, where fuel stops are sometimes days long because of rough water Also, Horta can be passed up, with longer-range ships, on a direct transatlantic trip The Yankee Clipper has been pulled off her run, equipped with bigger tanks, given increased horsepower and new propellers Tests show she can make 4000 miles non stop Other ships of the class will be changed accordingly

Since time schedules have been cut on South American services, traffic has increased 20 percent Delivery will begin next spring on six new Boeing A 314s which have some refinements over the 314, plus more power and more fuel It should be noted that the Priorities Board will not curtail deliveries of planes to PAA, all of whose lines are vital to defense

PAA will start regular transatlantic service on a six-day-a-week basis July 1 The Company filed application for rates to be set on outbound trips Mail rates requested are somewhat higher than those asked for in an application last December Daily air service on the Atlantic while shipping is restricted will convert a large number of people to ocean flying for peacetime

Transcontinent Shortcut

Proposing a 222-mile shorter airway between Los Angeles and the East Coast, via the midcontinent route, Western Air Express has filed application with the Civil Aeronautics Board for a route from Los Angeles to Denver, thus cutting the flying time to Chicago and Eastern Cities

William A Coulter, president of Western Air Express, said the new route would be flown via Las Vegas, Nevada, and Grand Junction, Colorado Connections would be made at Denver with regular schedules of United Air Lines

If the application is granted this will represent the fourth airway east out of Los Angeles to be pioneered by this airline Western Air Express developed the Salt Lake City route which it now operates, and also the routes to Kansas City, El Paso, and Dallas, now flown by other carriers Until 1934 Western Air Express served Denver on two airways, from Cheyenne to El Paso, and from Denver to Pueblo and Amarillo

OPENING THIS MONTH is New York's new Airlines Terminal Buses will carry passengers from this building across from Grand Central Station to LaGuardia Airport. (Story p 78)

A 'GUIDING ANGEL" wins the Frank M Hawks Memorial Award for Frank P Lear, Dayton, Ohio Mr Lear (left), who invented the "gyrornatic navigator" is shown as Mayor LaGuardia presented the award at a luncheon in Rockefeller Center.

U. S. and Canada Agree On Air Commonication

In accordance with a tentative understanding reached by Canada and the United States at an aviation conference in Canada in 1939, the State Department in Washington, on December 11, announced that a formal agreement with Canada providing for reciprocal treatment in the operation of air routes connecting the two countries had been reached

The deal provides for the operation of a U S line from Buffalo to Toronto, a U.S. line from Windsor, Ontario, to any point or points in this country, a Canadian line from Detroit to any point or points in Canada, an American line from Great Falls, Montana, to Lethbridge, Alberta; and a U S. line from Bangor, Me, to Moncton, N B

Problems in connection with services to Alaska were held for future consideration, but Canada agreed to establish necessary aids to flight along the coast of British Columbia.

There was no indication that any of the routes authorized might be established in the near future, and there was no contemplation of any particular operators. It should be noticed that there is no mention of an extension from Lethbridge to Alaska Such a route would compete with Pan American Airways' coast route north from Vancouver,

Rate Meeting Postponed Operators File Briefs

Washington (AVIATION BUREAU)—The CAB conference with airlines on bases of rate making, scheduled for December 3, was postponed at request of the operators upon representation by them that they had other important matters to attend to. The Board granted operators' request that they be permitted to submit their comments on rate making in the form of briefs, to be filed not later than December 23 Briefs will be accepted also from other interested parties. No new date for the conference had been set at this writing

It was admitted in CAB circles that the rate scale, whatever form it takes, *will* be a trimming process How else, one official said, can the country ever hope to get on an all-first-class-mail by-air basis His idea was that rates must eventually be scored down to get on a volume basis. The carriers by that means would eventually get back to the same earning rate but would carry greater loads. There is no thought of putting all first class mail on planes, however, until after the present defense plane producing push

It was pointed out that the new basis, when it comes, probably will be a sliding scale of some kind that will work automatically, instead of forcing CAB to take the initiative against any operator who appears to be exceeding "fair and reasonable" profits No operator who is earning more than that will ask for a rate examination.

Weather the Cause of 1940's Three Crashes

As the airline men met in their semi annual safety conference with the Civil Aeronautics Board in Washington, 1940's third fatal accident fell in their laps

Final reports on the crashes at Salt Lake and at Chicago had not been completed as this was written The conclusion on Lovettsville was indecisive. But all three had one thing in common old men weather. Prevention of accidents is mainly tied up in radio and other navigation aids

Many hard problems remain, but many have been solved CAB reminds you that forced landings, structural failures, fires, are almost unknown Safety is so greatly improved that the public is losing its fear Insurance premiums are almost level with other transport

Though there is little hope of stopping air accidents completely, some anti-administration congressmen are again blaming the trouble on the political re-organization of the Civil Aeronautics Authority. Actually, informed observers can see no direct connection between politics and these accidents Nevertheless, there will be a strenuous attempt to change the Washington set-up again

Among the proponents of more re organization will be the Air Line Pilots Association They will contend that the CAB, which now both makes the safety rules and investigates accidents, merely investigates itself when it examines a crash

American Export Line Studies Gulf Weather

Studies of high flying weather on its proposed trans-gulf straight line from New Orleans to Belize, British Honduras, thence to Cristobal, Canal Zone, are in progress by American Export Airlines Company is using the Consolidated twin-engined Model 28 which made the exploratory flights for AEA's transatlantic route, awarded by CAB last July.

The pioneer flight was made by Lowell Yerex, president of TACA, passenger and cargo system covering five Central American countries, recently purchased by AEA. Company says that plenty of weather data are available around the Gulf rim, but none on the cut-across. Detailed reports were transmitted at half-hour intervals to AEA's New Orleans headquarters

AEA has had much weather reporting experience in connection with its parent shipping company, American Export Lines, which is the only regularly-scheduled steamship service to Europe since the neutrality law cut off Northern Europe and Gibralter

Pan American Airways, American Export, and American Airlines (which has secured a permit from Mexico to operate into Mexico City), are all three in a tussle for rights south of the border Both AEA and AA have yet to get approval of their applications from CAB

For its trans-gulf service, AEA is ordering a number of four-engined Lockheed transports of a new design.

AIR TRANSPORT INDICATOR

December 1, 1940

131.8

Which is the ratio of passenger miles reported by the Air Transport Association for all domestic lines for November, 1940 to the figure for November, 1939 Total for the indicator has continued its slump from the year's peak For the first eleven months of 1940 traffic stood at 963,916,635 revenue passenger miles—up 31.8 per cent over November 1939

See Finance page for individual companies' traffic figures.

By Raymond Headley

The aircraft industry turned in a banner year for 1940 from all financial aspects—record sales and earnings, further dividend checks and more all-then strengthened financial structures and conservatively financed plant expansion. In its evolutionary process of becoming a mass production industry, aircraft manufacturing bids fair to improve further its fiscal status in 1941. Enlightened aviation leaders already have a wealthy eye cocked for the deflationary period that is sure to follow completion of the defense program. This is one of the healthiest signs of the times. Aircraft makers will be burdened with further heavy taxation and other higher costs. Yet with production steadily mounting higher, somewhat larger earning power appears likely this year.

Restrictions on the delivery of commercial aircraft caused considerable concern in Wall Street when the subject first came up. From a dollars and cents standpoint, however, the forced deferment of plans to expand existing routes and establish new runs has its bright aspects in an otherwise disturbing situation. It takes many months to put new routes on a paying basis and some of the airlines, at least, will welcome a breathing spell to consolidate their expansions of the recent past.

The airlines have approximately 320 transport planes in operation, and nearly as many more on order. It is felt in trade circles there is enough new equipment, along with coordinated efforts on the part of the airlines, to take care of most of the normal traffic increase this year. However, with a 100 per cent gain in air traffic forecast for the next two years the industry may become seriously short on equipment in 1942. If strict priorities on equipment prevail, priorities on who can travel by air will necessarily follow.

Stock transactions by officers and directors of aviation corporations during October, 1940 included the sale of 3,000 shares of Aviation & Transportation common stock by L. B. Manning, Chicago, while C. R. Smith, New York, purchased 4,500 shares of American Airlines capital stock, according to the Securities and Exchange Commission.

Stockholders of aircraft and aviation accessory concerns received more liberal dividend treatment last year than ever before, but the payments in most cases were conservative in view of the increased earning power experienced by the majority of companies. The current need for lots of cash to finance defense orders undoubtedly curtailed the size of some dividend payments.

The dividend declared by Roosevelt Field, Inc. in December 1940, deserves special mention as it is probably the first time that a privately owned airport has shown sufficient profit to reward its patient stockholders. This Long Island airport has moved forward during the past few years from a deficit condition to one of real progress in sound financial status. The following table gives the common stock dividend payments declared by a number of aviation and allied companies in the past two years. Only one of the larger air transport companies made a dividend payment in 1940.

	1940	1939
Aero Supply	$0.15	$0.20
American Airlines	1.00	none
Breeze Corp.	1.00	0.50
Brewster	0.25	0.20
Consolidated	2.00	none
Curtiss-Wright	0.50	none
Douglas	5.00	3.00
Ex-Cell-O	2.50	1.00
Irvin Air Chute	1.25	1.00
Lockheed	1.50	1.25
Martin	2.00	1.00
North American	1.50	1.40
National Aviation	0.75	0.75
Square D	2.50	1.75
Sperry	2.00	2.00
United Aircraft	3.50	2.00

Some deliveries of the aircraft manufacturers are now running in the neighborhood of $80,000,000 a month, as compared with a monthly average of approximately $52,000,000 in 1940. Shipments last year totaled around $625,000,000, according to preliminary estimates and compared with deliveries of $225,000 in 1939, the best previous year.

Passenger traffic on the domestic airlines in November showed an increase of around 30 per cent over the corresponding 1939 period but was about 30 per cent under October, 1940 usually the peak month of the year. Preliminary reports indicate that approximately 970,000,000 revenue passenger miles were flown by the domestic lines in the first 11 months of 1940, as against 612,300,000 in the similar 1939 months, a gain of nearly 60 per cent.

Lockheed Aircraft reports net sales of $33,812,000 for the first ten months of 1940, as against $28,264,000 in the corresponding 1939 period. A breakdown of the $283,000,000 Lockheed backlog of unfilled orders reveals that $250,000,000 represents military orders for the United States and British Governments while the remaining $30,000,000 consists of commercial transport orders. However, of this $30,000,000 only $4,000,000, or less than two per cent of the entire backlog, is being put through the factory at the present time. The other eight percent of the commercial orders are for future models not yet in production.

A similar breakdown of Douglas Aircraft's unfilled orders brings out the fact that only nine percent of the $360,000,000 backlog is for commercial airlines and another one per cent for foreign airlines. Slightly more than 100 Douglas DC-3 transports are on order from airlines in this country while the number of giant four-engine Douglas DC-4's is about sixty-two.

Irving Air Chute has a backlog of $3,000,000, about equally divided between the Buffalo and Canadian plants. A sharp pick-up in demand for parachutes from the United States and British Governments has caused the company to install additional equipment which will increase capacity 25 percent. After operating well below its capacity levels for some time past, the rush of new orders will step up the production schedule from 50 to 150 parachutes a week.

An analysis of the foreign power of two leading aircraft companies by Hare's Ltd., an investment company specializing in aviation stocks, illustrates the sharp increase in both earnings and taxes which these companies experienced last year. For the first nine months of 1940 Curtiss-Wright's earnings exceeded those of the similar period of 1939 by 132 percent. This gain was obtained in spite of drastically increased taxes which took 60 percent of 1940 earnings as against 20 percent of 1939 earnings. In the case of United Aircraft, profits for the first nine months of 1940 increased 60 percent while taxes, which took 17 percent of United's earnings in the first nine months of 1939, amounted to 51 percent of 1940 earnings.

Industry Backlog

The aircraft industry enters the new year with unfilled orders slightly above $3,500,000,000, more than four times the size of the $880,000,000 record backlog on hand only a year ago. Meanwhile, with a large supplementary military aircraft program being formulated in Washington it is evident that new production demands on the industry will push unfilled orders to higher levels shortly, despite the steady acceleration of shipments month by month. New Government-owned assembly plants in the Middle West will be built to turn out bombing planes costing approximately $1,000,000,000 a year—a figure nearly half the value of the automobile industry's annual output. Motorcar factories may fabricate about forty per cent of the parts used in these new plants. Although the aircraft industry has doubled its shipments in the past twelve months, it does not appear likely that the current rate of deliveries again can be doubled quickly enough to complete all 1940 orders by the April, 1942 deadline. Some manufacturers expect to be working against present orders through the better part of 1942. The following table gives the latest approximate unfilled orders of 23 primary producers of planes and aircraft engines.

Allison	$164,800,000
Aviation Corp.	15,000,000
Beech	23,000,000
Bell	50,000,000
Boeing	240,000,000
Brewster	100,000,000
Cessna	11,000,000
Consolidated	332,000,000
Continental	36,000,000
Curtiss-Wright	500,000,000
Douglas	360,000,000
Fairchild	15,000,000
Ford	122,000,000
Grumman	20,000,000
Lockheed	280,000,000
Martin	325,000,000
North American	215,000,000
Northrop	27,000,000
Packard	217,000,000
Republic	60,000,000
Ryan	12,000,000
United Aircraft	430,000,000
Vultee	95,000,000
	$3,614,800,000

An increase in air traffic that by 1945 would result in a volume 20 to 30 times what it is today is expected by Federal airways

experts, who also predict that eventually all first class mail will go by air. Meanwhile air express shipments are at an all-time high, making a gain of 23 percent in the first nine months of 1940 over the similar 1939 period.

Here And There . . . The *Lockheed* and *Glenn L. Martin* Companies have financed their large plant expansions without federal aid . . . Aircraft payrolls will reach a peak of about 382,000 late in 1941, as against 164,000 in December, 1940 and 60,000 a year ago . . . *Northeast Airlines Inc.* (formerly Boston & Main Airways) is preparing to raise about $500,000 in new capital . . . *Aircraft Mechanics Inc.*, Colorado Springs, reports a $500,000 backlog and is negotiating new contracts amounting to around $3,000,000 from *Douglas Aircraft* . . . Aviation concerns in Los Angeles County have aggregate backlogs of around one billion dollars . . . *United Air Lines* is spending $600,000 annually on its new pilot training program . . . *Eastern Air Lines* expects to break all previous records for traffic in the current winter season . . . *Northrop Aircraft* deliveries should reach a $1,500,000 monthly peak by November . . . *North American* probably will report smaller earnings for 1940 than in 1939 as larger foreign deliveries—carrying higger profit margins—were made in 1939 . . . The Allison aircraft engine division of *General Motors* employed only 60 men a year ago while over 7,000 are now employed in Indianapolis, and 1,750 men are working at the Cadillac division in Detroit making engine parts . . . *Breese Corp.* reports 1940 sales up to November were $3,590,015, compared with total sales of $14,436,000 during the last thirteen years . . .

When plant additions already contracted for are completed the aircraft industry will have more than four times the floor area it had at the beginning of 1940, according to a recent survey compiled by the Aeronautical Chamber of Commerce. Makers of air-frames, engines, propellers will have more than 45,000,000 square feet of productive floor space, as compared with slightly less than 12,000,000 feet at the close of 1939. The cost of this expansion to the industry and to the United States, British and French Governments, all told, will aggregate $315,000,000. But the picture is not yet complete as several additional huge expansion projects are on the way.

Airline Doings

Northwest Airlines' fleet of DC3 Transports was increased to 18 planes when a new ship arrived from the Douglas factory. Since the arrival of the first Douglas plane in May 1939 this type ship has flown 5,600,000 miles, on the Northwest routes.

Air Transport Association announces that the increase in air passenger volume during the first ten months of 1940 over the same period in 1939 was 61.42%.

American Airlines adds another major city to its system by establishing service to Albany, N. Y. Ceremonies mark the occasion.

Pan-Central takes an interest in celestial navigation. Capt. Cecil Northrop heads pilot group fostering the plan. Capt. Northrop holds a master mariner's certificate. PCA's object is to coordinate its activities with PAA, which teaches celestial reckoning instead of radio beam technique.

TWA inaugurates four engine, 33-passenger Stratoliner service into Philadelphia and Pittsburgh, to bring the two cities an hour and a half closer to Kansas City and West Coast. A new airline network for Kansas is sought by TWA in an application for service to Hutchinson, Salina and Topeka.

Braniff Airways was denied a new route between Kansas City, Mo. and Memphis, Tennessee, by the CAB.

Texas is U. S. air terminal champion with 16 cities served by air transport. Florida is next with 13, and California is third with 11.

Eastern Airlines has a new six months training program for pilots, 60 of whom have completed the extensive course. Larger part of training is given at LaGuardia Airport. Some at Atlanta and Miami.

Canadian Colonial Airways operates ski-plane service from New York City to snow resorts in the Laurentian mountains.

Northeast Airways has permission from the Board of Transport Commissioners, Canada, to operate a branch airline from Bangor, Maine to Moncton, N. B. This is first Canadian-American line authorized since the recent U. S.-Canada air conference. CAB stated "national defense considerations" prompted the move.

Fixed Base Operators Form New National Training Association

By Wm. A. Ong

President National Aviation Training Association

At last the fixed-base operators have formed their own association. Operators from all parts of the country gathered at Kansas City on December 2 and 3 and organized under the name of The National Aviation Training Association. It is firmly believed by the members that this is the beginning of a permanent association that will be of inestimable value to both themselves and to the future progress of aviation.

The Kansas City meeting was attended by more than 200 operators, manufacturers and service company representatives. A great deal was accomplished in the two days. In sessions that were presided over for the most part by J. H. Wilson, head of the Lewis School at Lockport, Ill., the convention adopted a constitution and by-laws, elected officers, named a board of governors representing the seven C.A.A. regions, and instructed the governing body to incorporate and then take up the "unfinished business" of trying to settle the many unsolved problems harassing the non-scheduled operator, and particularly the flight instruction contractor under the government's Civilian Pilot Training Program.

Officers elected were as follows:

President: Capt. Wm. A. Ong, President of Ong Aircraft, Kansas City.

Vice-presidents: Leslie H. Bowman, Aircraft Sales Co., Ft. Worth, Texas; and Col. Roscoe Turner, Turner Aeronautical Corp., Indianapolis, Ind.

Treasurer: Maj. John C. Bennett, Jr., President, Louisville Flying Service, Louisville, Ky.

Board of Governors: First Region, F. Leslie Marsden, Buffalo Aeronautical Corporation, Buffalo, N. Y.; Second Region, Wesley N. Raymond, Raymond Aviation School, Inc., Macon, Ga.; Third Region, John H. Wilson, Superintendent, Lewis School of Aeronautics, Lockport, Ill.; Fourth Region, John W. Randolph, president, National Airways, Inc., Durant, Okla.; Fifth Region, David W. Krotz, president, St. Louis School of Aeronautics, St. Louis, Mo.; Sixth Region, Bertrand Rhine, president, CPT Association, Sixth Region, Los Angeles and Seventh Region, A. A. Bennett, Bennett Airways, Inc., Idaho Falls, Ida.

The executive board engaged C. R. Mooney, Kansas City, as secretary. Mooney is known best in aviation circles as secretary of the Southwest

Wm. A. Ong

Aviation Conference. Headquarters office was opened in Kansas City, address Hotel Bellerive, 214 East Armour Boulevard.

By special instruction voted on the convention floor, all members enrolled before January 1 will be listed as "charter members." Active membership is open to all flight-training operators under the CAA program, the co-ordinators for both college and non-college connected student quotas, and all fixed-base operators in their various classifications.

Associate memberships are provided, available to aircraft manufacturers, accessory dealers, service agents (such as insurance) and all types of individuals or firms participating in the business of the fixed base operator or flight trainer. Both active and associate membership dues are $10 a year.

The national organization was created with four regions already organized — the Third, Fourth, Fifth and Sixth. The First Region was started on a temporary basis prior to the Kansas City meeting, and is yet to be established with permanent officers in charge. The Second Region was scheduled to organize immediately after the national association had been established. The Seventh Region is expected to swing into line soon.

The procedure devised will give every operator member an opportunity to place his difficulties before the highest officials in the CAA or any other bureau in Washington. Local and Regional committees will receive all complaints. When one operator's problem is found to be general, and not simply an individual affair, that problem will be stated as a petition formulated by a regional committee. That committee will clear the problem through the national association to be placed before the proper government official.

In this way, the organization plans to co-operate with the CAA department heads and other officials, working out all difficulties to improve the flight-training program throughout the nation. The college co-ordinators, operating in some instances as a separate division, at other times operating jointly with all other sections of the N.A.T.A., will co-operate in helping solve the difficulties which have beset this tremendous enterprise, the CPTP.

This association is another 'first' in aviation. This is the first time that aircraft manufacturers, flight instructors, airport managers, representatives of the press, the co-ordinators and laymen in the air industry have gathered together in a single united effort to continue a constructive aviation program.

Members of the new association are the greatest single influence in civil aviation today. This group represents 60 per cent of the buying power in the private plane field. The operators, and the pilots they represent fly more miles than all the airlines, buy more airplanes, more gas, and oil and accessories. When we have completed our organization, we will be able to wield the greatest influence for the benefit of private aviation that this country has ever seen.

Credit for the initial energy in organizing the N.A.T.A. belongs largely to Les Bowman whose services were recognized by his election to one of the highest offices. Mr. Bowman started the campaign last summer which culminated in the organization meeting at Kansas City. Under the impetus of his inspiring drive, the CPT Association, Fourth Region was organized. By invitation from the officers of that regional association, headed by John Batchelor as president, operators from the Second and Fifth Regions assembled at Wichita. There the Fifth Region CPT group was created, under my leadership. There also, Les Bowmen and I agree to push the preliminary organization work in other Regions, leading up to the national conference. Bowman went to the West, and I tackled the Third and First Regions by long-distance telephone and followed up by meetings held at Chicago and New York.

Today the N.A.T.A. stands prepared to give every assistance possible to the C.A.A., and to co-operate in every way asked by other government officials, in the patriotic objective of building up America's reserve of pilot personnel. The speakers at the Kansas City convention pointed out repeatedly that the CPTP, by carrying on the weeding out process among untried youths ambitious to fly, had filed a list of recommended prospective pilots with the military air services and at a lower cost than could be performed in any other way.

The purposes of the N.A.T.A. are much broader than training of youthful pilots for possible induction into military service. As stated in the association's constitution, the objects are to:

1—Encourage public interest in flying activities.

2—Stimulate individual participation in all divisions of aeronautics.

3—Advance popular education in all aeronautical subjects.

4—Sponsor the science and practice of aviation.

5—Foster all aeronautical enterprises represented by the association's membership.

Resolutions adopted at the convention declared in favor of these principles; that the CPTP be continued on its present basis by formal action of the Congress, that the association will work toward co-ordinating the CPTP flying schools with the CAA, the National Defense board, the Army and the Navy, to the best interests of national defense; that a study be inaugurated to devise, if practical, a system whereby CAA flight training contracts could be let on yearly basis, instead of the present term-to-term deal; that educational institutions allowing college credits for flight and ground lessons performed satisfactory be commended and that schools not allowing such credits be asked

to establish a similar policy that the National Administration and the Priorities Board be asked to give full consideration to the need of developing our air transportation system to the utmost extent practical at this time, as a preparatory defense measure, weighing all aspects of that problem in proper relationship to the principal objective of developing an adequate national defense.

Potential membership in the association includes all CPT Operators, who number more than 700, all college co-ordinators, an equal number, and an estimated several hundred more non-scheduled operators, small airplane manufacturers, supply houses, accessory dealers and agencies servicing the small aeronautical concern in any and every manner. The officers of the N A T A hope to have an enrollment of more than 1,000 before February 1, and a membership growth in future years limited only by the size to which the private aviation enterprise can be developed in the United States.

Light Plane Exhibition

Plans for the Light Airplane Exhibition to be held in the National Sportsmen's Show at Grand Central Palace, New York City, February 15-23, 1941, continue to make excellent progress. Seven makes of light planes are already scheduled to be shown as we go to press, while many leading schools for flying and mechanical training, equipment firms, and aeronautical publications have taken booth space. Included among these latter, the Civil Aeronautics Authority will sponsor an educational exhibit on its pilot training program, and the Model Airplane Club of the Air will broadcast a radio program.

Though the Exhibition will have the character of an individual plane showing, it will be included in the regular Sportsmen's Show admission, and thus an audience of about 200,000 people is expected.

ACC News Is Born

Dedicated to the expansion of private aircraft sales, the Aviation Credit Corp. of St. Louis, has inaugurated a news publication for aircraft distributors of the country. Known as *The ACC News*, this publication attempts to carry information of interest to all fixed base operators.

First issue of *The ACC News* indicated that total sales of lightplanes for 1940 will exceed 1939 by 70 percent on a basis of units sold, and by approximately 65 percent by dollar volume. Predictions for 1941 indicate a 100 percent increase over 1940, requiring a production of more than 5,000 lightplanes for the period. A survey shows that 36 percent of all private planes are being sold on automobile type finance plans. "Fleet" finance plans, covering purchase of two or more planes by operators, are also proving popular.

TRAINING

Spartan School at Tulsa is expanding rapidly. Six new buildings were recently completed, bringing the total number to 24. Expansion since last May has cost some $450,000. Over 2,800 graduates a year are now being turned out. A class of 112 Air Corps Cadets is now in the school. Total number of flight instructors is now 110 at the main school and at the branch at Muskogee. New trainers, new engines and considerable other equipment has been added to that of the school. Robert L. Mann, formerly an engineer with Douglas and Northrop, has joined the school staff as chief engineering instructor.

The American School at Aircraft Instruments, Glendale, Calif., has been approved by the CAA as Approved Instrument Repair Station No. 1028, according to Herbert W. Hartley, president.

In line with the expanding need for instrument men the school has recently tripled its floor space and quadrupled its training equipment and facilities. The school is now divided into four shops: Primary, Advanced, Sperry Instruments, and Instrument Installation. All of these departments are laid out and equipped in the same manner as a large airline maintenance base instrument department.

Flying activity at Vail Field, Los Angeles, opened in October by the United Flying Schools of America, has expanded rapidly. The first hangar is already leased to capacity and a second is under construction. United Flying Schools is training 30 CAA secondary students, in addition to primary and secondary instructor training. Four Waco YPT-14 trainers are in service in addition to a Fleet, a Waco INF and two Porterfields. All training planes are being equipped with ultra high frequency radio receiving equipment for traffic control and instruction work.

Forty California flying school operators recently met in Los Angeles to form the Civil Pilot Training Association of the Sixth Region. Bertrand Rhine, Los Angeles attorney and private pilot, was elected president. Other officers are: Harry White, Palo Alto Flying Service, vice president; Banks W. Smith, California Flyers, Inc., secretary-treasurer. Directors elected were: Joe Plosser, Glendale, Arnet Speer, San Diego; Sol Sweet, Visalia, Seymour Davison, San Francisco, all in California, and Jack Connelly, Phoenix, Ariz., and Art Mortensen, Ogden, Utah.

Junior Airway Traffic Controllers are needed by CAA. Jobs pay $2,000 and applicants must have experience in aircraft operations in such jobs as dispatcher, airport station manager or in military flight operation. Details can be secured from the U. S. Civil Service Commission in Washington.

Tractor operators are wanted by the Royal Canadian Air Force. Applicants must be over eighteen, must be physically fit, and have had experience in operating crawler or caterpillar tractors. Apply at any of the recruiting centers in Canada.

To increase facilities for training Army Air Corps mechanics, and to accommodate increased enrollment of the civilian school, California Flyers School of Aeronautics, Los Angeles airport, has taken overall space in hangar Five, and is building a new engine test building and new administrative offices. One of two schools in Southern California conducting the U. S. Army aircraft mechanics training program, California Flyers now has 200 Army Air Corps enlisted men under instruction.

Cincinnati has a new Aviation High School where students will be trained for the new plant of Wright Aeronautical Corp. Over 800 students are already enrolled. Some 700 students registered for evening school training.

Philip Palm

DON'T LOOK NOW, but there's snow headed your way. Airports all through the northern states and in Canada face critical snow removal problems. At Traverse City, Mich., where Penn Central's ships rail in all winter, the only section of the field that is plowed is directly in front of the hangar where passengers alight. The runways are rolled.


Philip Palmer

THIS HALF TON ROLLER packs snow on the runways hard enough so that transports can land without trouble. Last winter the compressed snow was 15 in. deep on the 300-ft. wide runways. Four hours of work on each runway are required to do the job after a snowfall. Wood planks are always well oiled to keep snow from sticking.


Philip Palm

A PENN CENTRAL BOEING coming in at Traverse City after having landed on a snow packed runway. Pilots soon learn to put their ships down smooth and easy on the packed snow runways. During heavy snowfalls, the runway in the prevailing wind direction is packed first. This type of snow handling is adaptable to many airports.

Recent Books

THE AVIATION MECHANIC, *by Carl Norcross and James D. Quinn, Jr.* Published by McGraw-Hill, New York. 570 pages, price $3.

This is a basic textbook for students taking aviation courses in high schools, private aviation schools and in National Defenses classes. It is divided into three parts. The three chapters of Part I cover the importance of mechanics' work, a discussion of modern airplanes and how airplanes fly.

Part II is devoted to the construction of airplanes. In four chapters the authors discuss the materials and methods of airplane construction, and then give a step-by-step description of how airplanes are built. This covers all types of planes from light trainers to the trans-oceanic Clippers.

Part III covers airplane and engine maintenance as practiced in airline and military overhaul shops and also in those devoted to the private-owner planes. Thus the book includes all phases of instruction given in both short and long courses for mechanics.

The book contains the most complete collection of photographs of construction and maintenance that has been put into book form. Picture captions are unusually complete and add greatly to the value of the book. With both aviation schools and high schools training thousands of new men for the expanding airplane factories this should be a timely book.

THE AIRPLANE AND ITS ENGINE, *by Chatfield, Taylor and Ober.* Published by the McGraw-Hill Book Co., New York City, 414 pages, $3.00.

This is the fourth and revised edition of the very widely used and well-known book, first copyrighted in 1928. The style of the book is written for the reader who desires a sound knowledge of the basic principles of the present airplane and its power plant, without going into the subject as deeply as would be essential for the designing engineer or the expert mechanic. To do this the technical material in the book can be understood with only an elementary knowledge of physics or mathematics. The opening chapters of the book describe in detail the essential parts of the airplane including a theoretical study of the aerodynamics affecting the airplane. After the first five chapters a similar study is given to the airplane engine and following this the propeller, so that the airplane is studied in its essential parts before any discussion is given as to the performance of the airplane as a whole. Following this basic study, the remaining chapters of the book give a mathematical and descriptive discussion of airplane performance and airplane maneuvers and the closing chapters of the book describe the various types of commercial and military airplanes including aircraft instruments and accessories.

For one wishing a cross-section of the theory of aerodynamics and engine operation, as well as a description of the actual airplane as it exists today, this book should be extremely valuable.

INSTRUMENT FLYING. *By P. V. H. Weems and Charles A. Zweng.* Published by the Weems System of Navigation, Annapolis, Md. 328 pages. Price, $4.00.

Any book published by the Weems organization is sure to be a sound, practical book. This one is no exception. It has been written to aid pilots in meeting the requirements for the U. S. Government instrument rating. It opens with a basic discussion of instruments and classifications. Then it takes up the relations between instruments and goes on to discuss various steps in instrument training. The chapter on Instrument Training includes eleven lessons which, if followed, will give a pilot an excellent grasp of instrument flying.

Other chapter headings are Federal Aids to Navigation, Use of the Radio Range, Airways Meteorological Service, Meteorological Elements, Air Masses, Winds, Fogs and Ice, Observing and Recording Elements of Observations, Civil Air Regulation and Navigation. Much valuable material is included in the appendix, including a quiz section and a section on navigation equipment.

For pilots who are considering taking up instrument flying we know of no better book than this one.

PROCEDURE HANDBOOK FOR AIRCRAFT STRESS ANALYSIS. *By Nye, Hamilton, and Eames,* published by the Aviation Press, San Francisco, Calif. 334 pages. $4.

This book has been written with the express purpose in mind of presenting as simple a treatment as possible of the subjects of strength of materials and stress analysis as applied to the present-day airplane. The material in the book has been presented in such a fashion that it should be easily understood by readers who have had only the basic courses in mathematics and aeronautical engineering. Included in the book is a section dealing with the testing of material so that the reader can grasp a practical application of the theories and formulas described in other sections of the text. An appendix has been included to supply the student with a source of empirical data which should be very useful for design purposes, and together with this problems are presented throughout the text which illustrate the use of this data. Illustrations are in the form of drawings in reference to the mathematic material and a few photographs illustrating the section dealing with testing materials.

FLIGHT 7, *by Robert E. Johnson.* 242 pp. and appendix. Dodd, Mead & Co., New York, N. Y.; $2.00.

For the busy aviation executive who is constantly being called upon to advise the sons of his friends and business acquaintances about how to get into aviation and what future lies therein, Bob Johnson, Director of Public Relations for United Air Lines, has written a time-saving book. "Flight 7" gives the answers, and the executive can turn it over to his eager visitors, secure in the knowledge that he is putting them on the right track and in a form which will answer their questions simply and in detail. Joe and Bill, likely lads and recent high school graduates, take airline mechanic and pilot courses respectively, and the reader follows their curricula and their subsequent airline jobs, meantime refreshing himself on the history of the early days, modern research, and air transport operation. Johnson places his locale at the Boeing School and United Air Lines, but the material applies to any of the major aviation schools and air lines. Although a trifle rosy, the book is realistic, and the table of aeronautical occupations which forms the appendix is excellent. We might wish that the title were more indicative of the content, and that there were more pictures, but we might also wish that the book reaches all high school boys, so that the defense program can be accelerated through elimination of many of these "must" interviews.

AIRCRAFT DIESELS, *by Paul H. Wilkinson.* Published by Pitman Publishing Corp., New York, N. Y. 286 pages. $6.

Written for the aeronautical engineer, the engine and airplane manufacturer, and the airline operator, this book is designed to bring out the advantages of the diesel engines for aviation and to describe the present state of development of the diesel in aviation in this country and abroad. To do this, the author has devoted several chapters in outlining the basic theory and principles upon which the diesel engine functions and then branches into the more direct application of equipment and

engines to carry out these theories

Included in the book is a description of the construction of different types of diesel engines as well as standardized pages of data on these engines for the ready reference of the reader The developments and mass production of the German Junkers Jumo Diesels are described for the first time and the construction of the well-known Jumo 205 diesel is given in the detail Towards the end of the book several chapters are devoted to diesel research and development as well as several equally interesting chapters on the application of diesel engines to present and future aircraft operation Included in this description are tables comparing the use of diesel engines with the equivalent present gasoline engines

The contents of the book are well presented both in the text and illustrations and should certainly be included in the library of those wishing to acquaint themselves with this very important field of aviation

AIRPORTS—SOME ELEMENTS OF DESIGN AND FUTURE DEVELOPMENT *by John Walter Wood* published by Coward-McCann New York, 364 pp, 8½x11 in, $12 50

If you have $12 50 and want to know all about airports this is your book. It is a large, handsome book with 444 photographs and 64 diagrams and plans. The book opens with a discussion of airport requirements and then gives a presentation in text and pictures of leading airports in North and South America and in Europe Following this there is a plan for traffic control at airports There are 22 appendices which contain a vast amount of information on all phases of airport design and activity

The author is a recognized airport authority His new book should be of great value to everyone concerned in designing, building or operating airports

YOUNG AMERICA'S AVIATION ANNUAL *By Frederick P Graham and Reginald M. Cleveland* Published by Robert M McBride & Co, New York 270 pages, $2

This new book may easily win the title of being the most dramatic aviation book of the year It contains scores of beautiful pictures and could be called a pictorial review of aviation

The book covers commercial aviation, Air Corps and Navy flying, manufacture, research, instrument, private flying and aviation schools While written essentially for the younger reader this book will contain much that interests people within the industry

CAREERS IN AVIATION *By Ben B Follett* Published by Waverly House Boston 254 pages Price, $2

Ben Follett has been in aviation for over twenty years and he has packed much of his experience into this book He reviews all of the principal jobs in aviation and gives practical advice to young people about how to qualify for such work He covers the work of pilots and tells what kind of training is necessary to get a pilot's job these days He discusses the work of airline stewardess other airline positions aviation mechanic, meteorologist, airport control and radio operators management jobs in aviation briefly describes the work of aeronautical engineers, and then takes up military flights in the Army and Navy

Some of the most valuable information in the book is that which pertains to the civilian pilot training program He gives in some detail the qualifications for the CTP program, tells what it costs and what it consists of, and describes where it is going This is an excellent book which we recommend to young people who are looking forward to careers in aviation

FLIGHT TRAINING FOR THE ARMY AND NAVY *By Burr Leyson* Published by E P Dutton & Co, New York. 283 pages Price, $2 50

The sub title of this book is 'A Manual for Pilots and Air Craftsmen, based on the official curricula of the Army Air Corps and Naval Air Service" The chapter headings of this book are as follows The Air, Theory of Flight The Airplane, The Airplane Power Plant, Aircraft Instruments, The Parachute, Meteorology, The Flying Cadet, Requirements for the Air Corps, Air Mechanic's Requirements The Flying Cadet—Naval Air Service, Requirements for Naval Air Service Reserve Training of Naval Fliers, Flight Training with the Civil Aeronautic Administration, Airport Traffic Control Procedures

The author has packed a great deal of interesting material into his book It will be especially valuable to the young man who is considering entering the Army Air Corps or the aviation branch of the Navy. The book contains some excellent illustrations and should prove to be extremely popular

FLIGHT 17—*by Henry B Lent*, Macmillan Co, New York 96 pp $1

Although written primarily for children this book will prove of interest, we suspect, to a large percentage of adults This is likely to be the case with all parents whose children are interested in aviation and want to know how an airline is run. This little book gives all the answers, from the ground up in concise and accurate form, but at the same time interestingly

And for those of us who may have the reputation of knowing "all about" aviation among our lay friends both big and little, this book will serve as a handy guide to refresh our memories, concerning many of the details of airline operation which we have never taken the time to learn

Flight 17 is the story of a single airline flight of the "American Arrow" Flagship from New York to Chicago But no detail is missed concerning how it is done, from prop to tail wheel from porter to pilot

MODEL AIRPLANE CONTESTS Published for Air Youth of America by D Appleton-Century Co 106 pages $1 25

This is the first official publication of Air Youth of America and it is an excellent job It is the most compact as well as most complete guide book for all those interested in model airplane contests

The book gives its readers complete information on how to run a model contest, including cost selection of sites, duties of officials contest equipment and complete material Official rules for sanctioned contests are given Although a small book, it contains all that is necessary to know how to run a model contest

AIRPLANE BLUEPRINT READING *By Alex M. Robson* D Van Nostrand Co, New York 59 pages $1 15

This is a small book but it contains an excellent introduction to blueprint reading Divisions of the book are as follows: Introduction and General Details; Drafting Conventions, Limits, Tolerances and Drawing Changes, Detailed Blueprint Reading, Assembly Print Reading Useful Reference Tables Answers to Questions This book should find a large sale among high school and aviation school students.

AN AIRMAN'S LETTER TO HIS MOTHER *by Frank O Salisbury* E P Dutton 50 cents

This letter, which is destined to become famous was written by a young R.A.F pilot just before his death It is the most moving and inspiring utterance which has come out of the war

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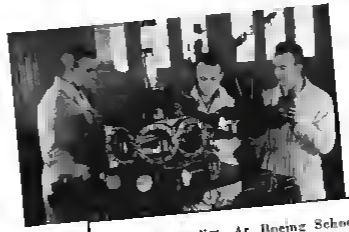

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BOEING SCHOOL OF AERONAUTICS

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Machine Scheduling

(Continued from page 51)

case a routing and scheduling tag will accompany the parts, showing order and part numbers, operation numbers, machines scheduled, dates to start operations and order due date. The latter procedure applies when the shop works from a bill of material or assembly detail breakdown, which is usually kept in the planning office, the fabricating shop foreman receiving only a daily parts schedule.

But for the smaller job shops, in fact for any of the parts shops, there is usually an advantage in having a shop order travel with the parts, with the operation requirements listed on it, so that all information is available with the job and the foreman is not asked to do so much checking.

The production checking for the planning unit may be done by the shop inspector, the man who moves the parts to the next operation, the timekeeper, or the shop order clerk. Different colored copies are made up when the shop order is written, which are fed back to the planner after the first and second operations and at the completion of the order.

In manufacturing plants going in for more elaborate control it is usual to have a "move card" written each time the parts are to travel from one operation to another, a duplicate being sent to the planning unit as a progress record.

In job shops it is desirable to attach to the shop order, at the time it is scheduled and released to the shop, a colored tag, red for past due or hot orders, green for work to be started this week but only after all red tag orders are put in the shop, and white for futures. The reason for this provision lies in the character of aircraft parts job shop work, which fluctuates greatly and keeps feeding in from the factories with considerable irregularity. Unless it is desired to have a dispatcher of orders in the planning unit available on all shifts, and present in the department where he can respond to all calls without delay, it is necessary to have orders released for the various machines somewhat ahead of time. But if orders come in today which are past due or otherwise hot, and the planner sends them to the shop with starting dates later than those on green tag orders which happen to be coming up for operation it is the red tag which places the new ones ahead of the green tag work. In other words, the work is scheduled on the machines in the order in which the shop orders are written from incoming purchase orders, but the starting dates represent priorities to the shop, which takes them from a rack where there is one compartment for each type and size of machine and for each tag group, red, green and white. Each week the shop order clerk changes green tags to red, or white to green, when necessary, thus pushing such orders ahead where their starting dates will act to give them true priority.

No orders should be scheduled without a due date acceptable to the factory and allowing time for the work to be performed following receipt of order. But by scheduling in order of receipt, first come, first served, thus making the starting time the criterion for priority, orders arriving late are not run to the disadvantage of other customers who have previously placed orders in good faith and with the expectation of receiving their parts on time. Yet there is no question of hot or past due orders being held behind future or next week's work.

There need only be enough orders released to the shop to furnish an adequate margin of work ahead of the various machines to carry over the night shifts and to take care of unforeseen difficulties, such as trouble with tooling requiring that the job be pulled down. Unfortunately, lack of material or tooling and irregularity on the part of the factories in releasing orders to the job shops has at times created some dearth of work for particular machines in the face of a general demand for shop capacity. This makes the use of the machine loading schedules all the more necessary, since the job shop is in a better position to put pressure on the factory to correct existing shortages on current orders in time to prevent machines being shut down.

The machine loading schedule in the planning office comprises two parts. The first is a master control chart (Figure I) listing in proper groupings, with machine one under another, all the machines in the shop. It is on the order of a Gantt chart, with vertical columns representing shop calendar days, preferably subdivided by shifts, since not all machines may be manned for second and third shifts. As full days of work are provided for given machines, horizontal lines are drawn in the spaces provided, showing this to be the case. As completions of full days of work occur, lines of a different color or character are drawn in the spaces corresponding to the work as originally scheduled. These chartings are taken from the data developed in the second part of the schedule.

The second part is the detailed machine scheduling. There is a loading card or sheet (Figure II) for each machine, the vertical rulings covering shop calendar days as with the master control chart, but the listing in the left-hand column is of the shop orders as received and scheduled for the particular machines. The items as listed include due date, part number, purchase order or shop order number as required, number of parts and estimated hours the operation will take on the given machine. A horizontal line is drawn in the spaces corresponding to the days the work is scheduled, with figures entered for times less than a full day.

At the time this charting is made the starting date is entered opposite the operation on the shop order, together with the machine number. The orders are charted as received. When a full day or number of days is charted for the given machine, this information is also charted on the master control chart as previously mentioned. All copies of the order being together with interleaved carbons still in place at the time the work is scheduled, each copy of the order bears the schedule information for all operations.

The shop is not required to put the job on a specific machine if another similar one is open at the time the job is put in work. But if the operation must be changed the dispatcher must first ok the change and see that the operation card is corrected if the change is to be a permanent one.

When the first operation is completed, the first order duplicate is returned from the shop to the planning office. Similarly, if a second order duplicate is utilized, this is returned when the second operation is completed. After the final drilling and burring have been completed the original, having been handled in connection with shipping or the storing of parts, is also returned to the planning office. This procedure applies to straight parts machining, and may have to be adjusted to meet the particular conditions involved when the parts go through several departments as in contract parts fabrication and assembly.

Even though the order has not been completely run it goes back to the planning office where proper steps are taken to re-schedule the job when the rest of the material becomes available. If a job is torn down to make way for an emergency run, the shop clerk collects and tags the parts, and places the order back in the shop office rack to be run as the next in priority.

If the second operation is scheduled to start before the first operation is completed, the second order duplicate may be placed in the shop order rack to take its turn in priority for that operation, the shop order clerk tagging and moving the parts. If the parts are

(Turn to page 106)

Machine Scheduling

(Continued from page 104)

moved to the point of second operation, the tag or order must be marked with a signal to show that this order must be put in work as soon as possible in line with priorities. Obviously the exact details of procedure depend upon the shop layout and the arrangements for forwarding work from operation to operation.

As a rule it is not necessary or advisable to try to schedule work many weeks in advance. If the shop is filled with orders calling for early delivery the future orders should be held for later charting as long as all the machines are kept busy. But if the volume of business shrinks and future orders must be put in work, there is no reason why these should not be scheduled as described, with red, green and white tags providing for the sorting out of priorities if more work immediately due be received.

For a small shop a convenient method of handling the individual machine loading schedules is to use stiff cards and tab them up for easy location, placing them in a box file. Or they may be in the form of punched sheets placed in a ring binder. Though not as compact as 8½x11 cards or sheets which must be dated in successive lines down the page as the weeks go by, longer forms covering several months may be used.

As an alternative method of setting up the charts, there is some advantage in building a machine schedule in the form of a rack fastened to one wall of the planning office arranged with vertical slots in which are placed colored cards which physically take the place of the lines on the Gantt type of master chart. In this case the detailed order information listed on the individual machine schedules described above is written on the cards, which are placed in the proper slots corresponding to the machines to be used and the days the work is scheduled. The advantage lies in the fact that the cards can be shifted. In some respects the Gantt type chart covering the detailed machine schedule is easier to refer to and work with.

The wall chart perhaps lends itself best to the scheduling of work in a contract parts shop where the full budget of jobs is determined from breakdowns of the contracts on hand. Other forms of wall equipment include boards with hooks and blackboards.

One point in favor of the Gantt type chart method is its flexibility. If the operation completions, as shown on the master chart, reveal that the shop is behind schedule for no reason discernable in the shop, it becomes obvious that the scheduling is too tight and some allowance must be made to compensate for this. If the shop is getting ahead of schedule steps must be taken to be sure more work is brought in as necessary, and the schedule tightened up. Where there is a great deal of rework coming in or many hot orders one machine in each group affected may have to be left open. Another way to compensate for this is not to schedule Saturday work but to look upon that time as a clean up period. These methods are more apt to be needed, however, in setting up a wall chart with the idea of scheduling the exact days the jobs are to be run rather than in using the Gantt type chart which in effect is used to build up the load of hours and depends upon the priority dating on the shop orders, as corrected by the red, green and white tags to control the order of work by the shop.

It is not possible to describe here in detail all of the factors in connection with machine scheduling which must be taken into account. The proper set-up is obviously an engineering problem which must be solved to fit the conditions obtaining in the particular shop. It is vital that material received whether factory furnished or shop purchased, shall be checked in accurately and reported to the planning office in such a way that orders may be scheduled when material is on hand.

It is desirable to arrange it so that the man making up the schedules be encouraged to keep in close touch with the shop, so that he understands the practical considerations connected with the work such as the desirability of using certain machines for certain jobs, the availability of special cutting tools and other equipment, etc. If the schedule-planner and the estimator are not the same man there is some reason for training them to be mutually interchangeable so one is able to spell the other or substitute during absences.

Finally it must never be overlooked that a primary reason for establishing machine scheduling is to relieve shop supervision of pressure. Just as the train dispatcher maintains the flow of traffic as a coordinated whole while the locomotive engineers run the trains, the planning unit sets up and controls the flow of work through the shop, while shop supervision see that parts are properly machined.

The keynote of national defense must be the teamwork of many men. Planning the work is a vital function which must be performed everywhere. The work must be planned in advance and every machine must be scheduled for all its hours if parts for more and more airplanes are to be built.

Jumo 205 and 207

(Continued from page 63)

gine to withstand the greater output and adding the exhaust-driven supercharger have added approximately 173 lb to the weight of the engine which is increased to 1,430 lb. Its specific weight is the same as for the Jumo 205 D, namely, 1.43 lb. per hp. Its specific output of 0.99 hp. per cu in. of displacement is a remarkable achievement for such a small engine.

The Jumo 207 functions in exactly the same manner as the various Jumo 205 engines and it too is equipped with a gear-driven ground blower. The blower is retained for starting and warming up the engine as otherwise there would be difficulty in obtaining the necessary scavenging air immediately the engine started running. During this preliminary period the exhaust gases are bypassed direct into the atmosphere through gates in the turbine casing. When it is desired to cut-in the turbine the gates are closed gradually and the turbine wheel is brought up to speed. The turbine wheel shaft is geared to the impeller of the compressor and when the turbine is in use the speed of the impeller is increased considerably. The impeller is of the closed channel type and is capable of speeds in excess of 30,000 r.p.m. Complete control of the supercharger output is obtained by regulating the gates in the turbine casing.

Specifications

Junkers Jumo 205 E diesel aircraft engine
Type: Six (twelve) cylinders, water-cooled, in line, geared, ground blower, two-cycle
Bore and stroke: 4.13 x 2 x 6.30 in.
Displacement: 1,014 cu.in.
Length and area: 80.0 in. x 7.5 sq.ft.
Rated output: 700 hp. for take-off
560 hp. continuous cruising
Total weight (dry): 1,257 lb.
Specific weight: 1.79 lb./hp.
Fuel consumption: 0.35 lb./hp./hr.
Oil consumption: 0.013 lb./hp./hr.
Compression ratio: 17 : 1

Specifications

Junkers Jumo 207 diesel aircraft engine
Type: Six (twelve) cylinders, water cooled, in-line, geared, turbo-supercharger, two-cycle
Bore and stroke: 4.13 in. x 2 x 6.30 in.
Displacement: 1,014 cu.in.
Length and area: 96.0 in. x 7.5 sq.ft.
Rated output: 1,000 hp. for take-off
1,000 hp. at 26,000 ft.
Total weight (dry): 1,430 lb.
Specific weight: 1.43 lb./hp.
Fuel consumption: 0.35 lb./hp./hr.
Oil consumption: 0.013 lb./hp./hr.
Compression ratio: 17 : 1

X-Ray

(Continued from page 47)

to the number issued on the work order and the entire lot placed on mobile carts to be taken to the X-ray machine. The die number remains on the part throughout its life. A record is made of the plane into which it goes so that a continuous history of its performance may be recorded.

This sytem of keeping track of each individual part has greatly aided aircraft manufacturers and foundries in carrying on their study of the performance of different materials. It has also made possible the removal of parts from planes after various periods of use for further X-raying and fatigue testing. Occasionally parts are passed that are considered on the borderline between acceptance and rejection. These studies make it possible to determine whether it is a safe practice, and assist in establishing more precise specifications.

After an X-ray exposure has been made, the film, together with pertinent information about time, angles and exposure, and the material photographed, is set aside to await the analysis of a highly trained diagnostician. With the complete file of X-ray information in front of him including the facts regarding the stresses, strains and corrosion the parts will encounter in actual use, the diagnostician is able to determine whether the parts pictured on the X-ray film will meet the requirements.

To assure the utmost accuracy, every result is checked, and every X-ray plate is checked at least five times. No chance is taken that a defect will be overlooked or misinterpreted.

The X-ray is only one phase of the research work done by our metallurgical diagnosticians. It tells us where defects exist, but not why. It has been in our efforts to find the answer to the "whys" of metallurgy that our researchers have made their greatest contribution. The results of their observations have assisted foundries in developing improved manufacturing procedure and better materials.

Used almost as much as the X-ray machines, is a spectrograph, a scientific atomic sleuth that can analyze the light bands given off by metal molecules and tell the kind of company they keep. If there has been any slip up in the mixing of the alloys, the spectrum shows where it has occurred, and provides the clue for further testing to determine why a part is strong or weak.

Because the spectrograph records its findings on a photographic film that can be projected and compared with the basic spectrograms of the metals being studied, this method of analysis has been referred to as "finger printing". It is actually spectrochemistry, and where speed is essential has replaced much of the chemical analysis formerly used in determining the composition of the alloys present in metals being tested.

This is done in one of two ways. A small sample from the part being tested is either pulverized and placed in a graphite electrode and vaporized by the intense heat of an electric arc, or placed directly in electrode clips and caused to emit light by means of electric current. Under intense heat or electric bombardment, every substance can be vaporized and decomposed into atomic elements which give off light of various but distinctive wave lengths. This light is reflected back through the spectrograph and dispersed into a spectrum by means of precision grating. This produces characteristic lines that are projected on to a 35 mm. film strip giving the spectrochemist a permanent record to study.

By checking the spectrum of the tested material with the spectrograms of known substances, iron, copper, zinc, manganese, etc., it is comparatively easy for the spectrochemist to determine the alloys that have been used in producing the metal. The presence of an alloy in a part in which it is not supposed to be used may prove to be the reason for its failure to stand up under required tests. Thus, while the X-ray is pointing out the presence of flaws—cracks, blow holes, shrinkage, shrink porosity, etc., the spectrograph is telling the experts why it is that these flaws exist.

A portable X-ray machine is also used in checking parts after they have been installed in planes. This usually occurs after a plane has been in operation for some time in order to determine how the parts have stood up under actual service conditions. Another valuable machine is a Southwark Emery machine that can determine compression or tensile strength of metals up to 300,000 pounds. Along with it is used a Riehle impact precision testing machine to determine materials' resistance to impact tension, and to correlate the X-ray findings.

To aid in the examination of flaws the X-rayers use a Busch Metaphot that permits microscopic enlargements from four diameters up to 2200 diameters, a General Radio Strobotac and Strobolux and a complete Edgerton Hi-Speed Spark camera capable of taking exposures of 1/100 000 of a second. Another important research tool is radium, utilized in taking gamma ray pictures and to insure the sharpest possible definition for radiographic photos.

To complete the correlation of their metallurgical investigation, Triplett & Barton operate a chemical testing laboratory.

Over a period of five years the metallurgical diagnosis of this organization have contributed to the improvement of foundry technique and production of better alloys and the strengthening, as well as the lightening of materials. All of which, have in turn affected to some extent airplane designing and construction.

For instance, in the interest of safety, the government requires manufacturers to use a 100 per cent safety factor for all castings. Due to the accuracy of analysis made possible by the X-ray and other laboratory equipment, the safety factor, where these aids to construction are used, is reduced to 50 per cent. This enables the manufacturer to use lighter materials and lighten the weight of the plane, without impairing its service strength. Further, the X-raying of parts makes it possible in many instances, to substitute castings for forgings and thus reduce the number of parts required, and in so doing eliminate some additional weight. Therefore, to the X-ray and its correlated metallurgical diagnosis can be traced lowered production costs, increased safety and increased payload.

In fact, since the inauguration of 100 per cent X-raying of all class 1 and stress parts there has not been a single mechanical failure due to faulty parts.

In utilizing these scientific aids to aircraft construction manufacturers have eliminated all guesswork as to the quality of materials used, and brought to mass production the highest possible factor of safety. Even though planes may be expendable items in times of war, and even though they may only have a brief career, no American plane will go forth under existing manufacturing conditions that does not give its pilot and crew a full fighting chance to return to its base.

There is one thing of which I am firmly convinced, and that is all aircraft manufacturers eventually will come to X-ray inspection of all class 1 and stress parts. The Army now demands it on all of its planes. Lockheed was the first to adopt it as part of its construction routine. Douglas, Consolidated, Boeing, North American and Vultee have added it within the past two years. Martin and Bell Aircraft are using X-ray inspection on their Army contracts.

It is the only non-destructible way that we can be certain of the soundness of the material going into a plane. To trust to machine shop inspection to catch the more obscure and dangerous defects is to run the risk of faulty parts being put into the plane, and that is to risk possible structural failure in the air.

IN 1941

Six WRIGHT PLANTS RUNNING 24 HOURS A DAY *for Defense . . .*

WITH manufacturing facilities trebled in the past year, the output of Wright Cyclone and Whirlwind engines is rapidly reaching the proportions demanded for an effective National Defense. Nearly 3,000,000 sq. ft. of factory area are now in use day and night. By mid-year the addition of the new Cincinnati plant will have increased this area by 50% to an aggregate of 4,500,000 sq. ft. . . . 110 acres of men and machines!

Such expansion is not a matter of buildings alone—an extended program of employee training has made possible the manning of new plants as fast as machines and facilities were available . . . new and improved equipment has been developed for faster and more accurate production . . . millions of parts must be completed on schedule ready to work with equal precision and efficiency in any engine assembly . . . no concession to quality is tolerated anywhere in the tremendously accelerated program . . . all this has taken time, study and coordination of the closest sort.

Wright has enlisted its fullest resources to provide a large part of the power required for the Defense Program and the months spent in preparation are already justifying themselves in rapidly increasing production. When the emergency is over, Wright will be ready to serve commerce and a continuing defense more efficiently than ever.

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AERONAUTICAL CORPORATION

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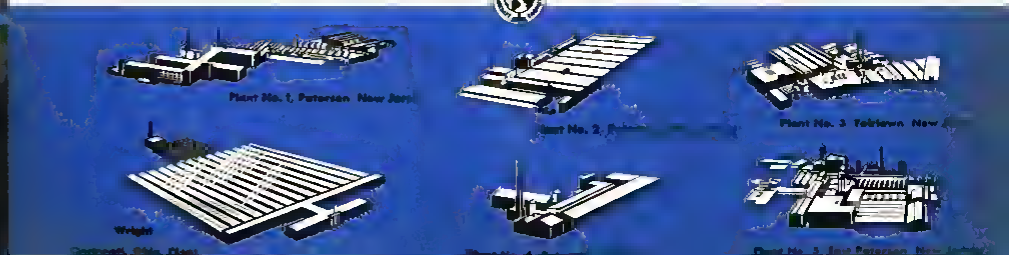

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TRIPLED CAPACITY PLANT

Proudly we Present for 1941

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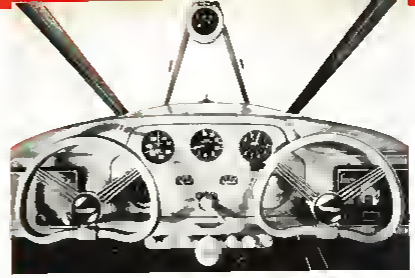
Choice of 5 New Interior and Exterior Modernistic Duo-tone Color Combinations AT NO EXTRA COST

Wheel Pants optional at extra cost.



★ **NEW "FUNCTIONAL" INSTRUMENT PANEL**

More than a masterpiece of beauty — completely functional in design • Provides for easy installation of blind flying instruments, including one or two-way radio equipment • Individual standard aircraft instruments properly grouped for functional use as approved by expert instrument pilots • Two glove compartments and ash tray • Panel finished in beautiful walnut grain • New, convenient grouping of plastic control knobs • Instrument sub panel mounted in rubber • New, plastic "knee free" control wheels • In every way this modern instrument panel is the most convenient and practical ever designed for light aircraft.

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Rich Duo-tone Mohair upholstery fashioned in the modern trend to harmonize cabin interior with exterior colors • Larger luggage compartment • New, convenient shell behind luggage compartment • New, rigid double panel doors tailored for snug fit • New, automatic door latches and streamlined handles • Door equipped with key lock • Adjustable door windows • Two new rear cabin windows for greater vision • All doors and windows draft-proofed by rubber seals and wind locing • Two controllable cabin ventilators.

The Sweetest Flying — Smartest Looking — Low-Priced Airplane

★ **50% INCREASE IN CRUISING RANGE**
Standard gasoline capacity increased to 18 gallons • Cruising range (no wind) 375 miles.

★ **FULLY WIRED FOR NAVIGATION LIGHTS**
Provides for quick, simple installation of lights whenever desired.

★ **NEW AIRLIRE TYPE TRIMMING TAB**
Convenient crank control located in cabin ceiling.

★ **BEAUTIFULLY STYLED COWLING DESIGN**
Sparkling Chromium grilles and streamline side molding.

★ **AND MANY MORE OUTSTANDING FEATURES FOR YOUR GREATER COMFORT, SAFETY AND PLEASURE**

Its "New-as-tomorrow" Styling and traditional Taylorcraft dependability will make you proud and happy to own this newest and finest economical airplane!

The price of a new Taylorcraft is among today's lowest. You can buy it with Low Down Payment — Easy Terms.

Visit your Taylorcraft dealer and see how easy it is to buy the new Taylorcraft De Luxe. Ask him for complete details on the convenient time payment plan. He cordially invites you to inspect the beautiful 1941 model and to take a demonstration flight.

Now for the First Time In a Low-Priced Airplane

★ NEW HARMONIZED DUO-TONE COLOR BEAUTY INSIDE AND OUT

From its sleek, lovely lines to its handsome cabin refinements, the 1941 Taylorcraft DeLuxe is a beauty to behold. Sparkling with a distinctive new modern type of style-beauty and flight-convenience features, this dependable, economical airplane will take your eyes and win your heart the minute you see and fly it.

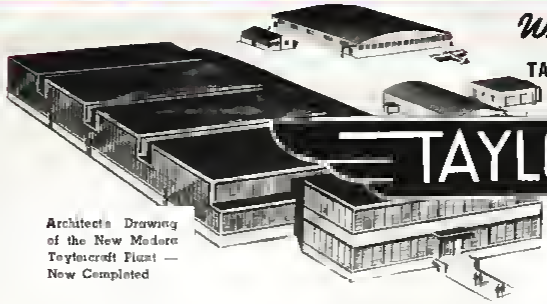
Taylorcraft's new Duo-Tone styling brings you the kind of color harmony you want, inside and out, with a choice of five delightful combinations.

Exterior standard finishes include Duo-tone Ivory and Metallic Red, Ivory and Metallic Blue, Yellow and Metallic Blue, Red and Black, and Yellow and Black.

And the cabin interior combinations harmonize with the exterior colors — a complete symphony of beautiful colors — at no extra cost.

This is but one of the many new advances that now feature the new 1941 Taylorcraft DeLuxe. Words alone cannot do justice to the beauty, comfort and flying performance of this stunning new, modern airplane. You have to see it — and fly it yourself. Only then will you fully realize the extraordinary value Taylorcraft offers you today.

Join now, with the thousands who will enjoy more fun in 1941 — with a Taylorcraft.



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DEPT. 15 ALLIANCE, OHIO

TAYLORCRAFT

AMERICA'S MOST MODERN LOW-PRICED AIRPLANE

Regulated Economy

(Continued from page 55)

just their schedules and carry more passengers by changing certain non-stop trips between the two cities into one-stop schedules Such an adjustment, according to estimates, would increase the payload of a DC-3 from 15 percent to 20 percent as a smaller supply of fuel would have to be carried for a one-stop trip than for a non-stop schedule More intensive use of equipment could also be obtained through eliminating the practice of scheduling simultaneous departures These and other adjustments leading to more efficient utilization of equipment are conducive to higher load factors and hence increased earnings

While "freezing" air line operations may exert a temporary restraining influence on the industry's normal growth during the next year or two, the long-term implications of the national defense program should clearly redound to the benefit of the air carriers Some day in the not-too-distant future our need for concentration in military plane production may no longer exist What then of the huge plant facilities for manufacturing fighting craft which war needs dictate? Equally important what of the vast reservoir of flyers created through emergency training both civilian and military?

At least two impeccable facts come to the forefront Instead of paying an average price of $125,000 for a 21-passenger transport plane, such equipment may in the future be available at substantial price reductions Moreover the monthly wage to pilots now ranging from $700 to $1 000 will undoubtedly submit to a drastic deflation The combination of these two elements alone presages material reductions in operating costs for the air lines Such a development can be conducive to broad reductions in passenger rates thus enlarging aviation's potential share of the travel market Increased volume along with a better profit margin are dynamic forces that augur well to enhance the ultimate profits of the air carriers

Restrictions placed on new plane purchases have also resulted in ramifications elsewhere As indicated a few months ago, all current air freight proposals have been predicated primarily upon the construction of a special cargo plane which will reduce ton mile cargo costs substantially below those of existing aircraft The development and construction of such a plane under existing conditions now appears remote As a consequence, practically all air cargo promotions have gone into hiding—for the time being at least, to await more propitious days

Here too, the cessation of hostilities may facilitate the construction of 'air-freighters' at low cost together with their economical operation In such an event, the air transport industry may attain even greater stature by obtaining an important share of the country's freight traffic

Come what may, air transport securities are rapidly assuming the characteristics of a "peace" stock and as such should prove a good hedge as contrasted to 'war-baby' investments

The rearmament program has reached the stage where outright mobilization of industry may be the next phase This trend was foreshadowed by Assistant Secretary of War Patterson who recently stated that businessmen "cannot resist priority urgently required by the needs of the Army" or hold back from vigorous effort because they are not sure what the effect may be on their business after the time of stress may have passed'

Events are gradually moving in the direction where greater control is being assumed by the government Officials of the NDAC are reported in favor of creating a "ministry of supply" The Navy has demanded a new defense agency which will catalog idle industrial capacity, review Army-Navy and British requirements, place orders and designate what products are to be manufactured by industry This phase will most likely develop into government war control of industries and all that it signifies! Price-fixing, rationing of supplies disciplining of companies that become laggards on national defense work, extensive government construction of plants, complete subordination of civilian needs to military requirements

The aircraft industry, as noted, has already had to sidetrack civilian demands Machine tools are in a similar category with the likelihood of other industries joining the procession in the months ahead Augmented British requirements along with new United States air corps, Army and Navy defense programs to be revealed at the 1941 session of Congress will undoubtedly strain capacity that certain controls may become inevitable

Unheralded in the welter of news pertaining to military aircraft production is the consistent progress being made by the lightplane builders Here is a new industry which produced more than 5,000 small planes for 1940 Expanded plant capacity should permit doubling production for this year While the $8 000,000 estimated as the aggregate value for the lightplanes produced last year does not appear significant when compared to the $625,000,000 of estimated deliveries for the entire aircraft industry for 1940, it nevertheless represents an important beginning for an embryo industry Interestingly enough, the automobile industry, during one of its early years, 1900, produced a total of but 4 192 cars with a value of less than $5,000,000

Practically all of the flivver plane production in the United States is accounted for by only four companies It is significant that the assets of these four companies aggregate about $2,000,000 Furthermore, based on current over-the counter market prices it is theoretically possible to purchase all of the equity issues of these corporations for about $3 000 000

The largest of these lightplane producers is the Piper Aircraft Corp which is credited with about 60 per cent of the total flivver sales in the industry Important factors in this trade also include Aeronautical Corp of America, Taylorcraft Aviation Corp and the Luscombe Airplane Corp

Recalling the fortunes made in obtaining an interest in a growth enterprise on the 'ground floor,' the investor may well suspect one of these lightplane builders as a profitable medium to new wealth While these lightplane manufacturers will probably continue to show an upward trend, it is difficult to overlook the huge production facilities of North American, Douglas, Martin and others stimulated by the rearmament program The production lines now devoted to heavy bombers and other combat planes can easily be converted to the peacetime pursuit of rolling flivver planes in volume

At some stage in the industry's development will come great manufacturing and financial enterprises which eventually may well compare with the General Motors and Chryslers of the automobile industry When the automotive industry was in its swaddling clothes, there were no counterparts of these present-day industrial giants The same is true today as to the manufacturing set-up of the lightplane industry as it is currently constituted It is logical to assume, however, that somewhere along the line, a General Motors or a Chrysler may emerge

When we need no longer rearm, a serious contraction of industrial activity and a consequent business depression appears ahead New products and new industries bid fair to minimize the duration and intensity of this depression. The flivver plane offers the promise of being that vehicle which may serve as the new product of a new industry to provide a substitute stimulus during the post-war readjustment period

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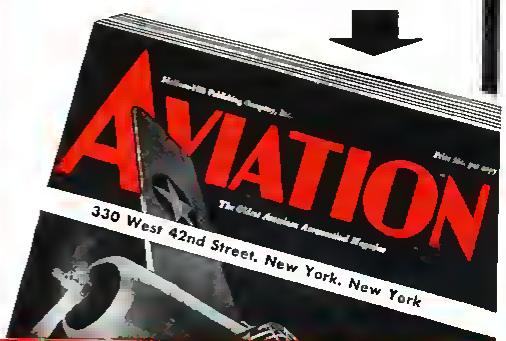


ALL IN ONE BIG COLORFUL ISSUE: Vital Engineering & Buying Data ☆ Latest Designs ☆ Sketches & 3-View Drawings ☆ Industry Facts, Figures & Personnel

Pressurized Cabins

(Continued from page 38)

tary missions at high altitude. The student who wishes to go more deeply into the physiological phase may consult Dr H. G Armstrong's book "The Principles and Practice of Aviation Medicine" or Doctors Boothby, Lovelace and Benson articles in the September and October 1940 issues of the *Journal of the Aeronautical Sciences*. These are considered excellent sources of information on the effects of altitude in the human body.

There are four main physiological effects of high altitude flight which we will briefly consider here. These are anoxemia or lack of oxygen, cold, aeroembolism or caisson disease applied to aviators, and the effect of rapid change of pressure on the passages of the ears. In discussing these effects it should be borne in mind that there is a marked distinction between the reaction to altitude conditions between a military pilot and a commercial passenger due to the fact that the former is presupposed to be in excellent physical condition before undertaking an altitude mission.

We are all familiar with the fact that an increase in altitude is associated with a decrease in atmospheric pressure, which is illustrated in Fig 1 where the change in pressure, plotted against altitude, becomes a curve. This curve is relatively steep between sea level and 10,000 ft, from which point it flattens out as 60,000 ft. altitude is approached. This is best shown by the fact that at 10,000 ft. the change in pressure for a rise or fall of 1,000 ft is about 0.4 psi, while at 40,000 ft. a similar change of altitude gives a pressure change of 0.125 psi. Fortunately for the pressure cabin designer the volumetric mixture of air remains the same up to approximately 72,000 ft, or in round numbers, 21 percent oxygen, 78 percent nitrogen and 1 percent inert gases. Since the density of the air also varies with altitude, it becomes necessary for purposes of comparison to talk about weight flow of air in preference to volumetric flow. For example, 15 lb per minute weight flow at sea level is approximately 196 cfm, while at 22,500 ft. the same weight flow is approximately 400 cfm.

Due to the decrease in air density, accompanied by a decrease in pressure as altitude increases, we find that it is necessary to breathe faster in order to produce the required amount of air in our lungs. When the 15,000 ft level is reached, breath becomes seriously shorter and bodies accustomed to sea level pressure tire very easily. At 19,000 ft sleep, or semi-unconsciousness, generally is experienced by an average individual and at 20,000 to 23,000 ft, the threshold of death from anoxemia, or lack of oxygen in the lungs, is reached. By using an oxygen mask beginning at an altitude of 15,000 ft, one may ascend to 18,000 ft where another body effect begins. This may most aptly be described by comparing the blood stream with a glass of water which bubbles as though carbonated at 18,000 ft. The bubbles in the blood stream are nitrogen and will have no ill effects on the body until approximately 29,000 ft. is reached. If ascent to altitudes greater than this is desired by use of an oxygen mask alone, it will first be necessary to thoroughly saturate the blood stream with oxygen so that upon reaching 18,000 ft some of the nitrogen will have been driven out and formation of bubbles will have been staved off until, at an altitude of approximately 40,000 ft, the threshold of death will again have been reached due to aeroembolism. In order to operate safely at altitudes of 35,000 ft. or higher, some device to maintain a higher pressure must be utilized in order to prevent the ill effects described. From the standpoint of the military pilot a pressure suit would suffice if it were not for a reduction of facility with which the wearer may move about. In the case of a commercial passenger, it might be difficult to induce a nice old lady traveler to garb herself as a man from Mars in order to reach her destination more speedily.

The low temperatures encountered at high altitudes, which may easily reach —70 deg between 30,000 and 40,000 ft, presents a problem whose solution is not quite so serious as that of preasurizing. It is true that at this low temperature the warmth produced by heavy clothing will not be sufficient to maintain livable temperatures mainly because the heat loss alone from the lungs by conduction and vaporization is greater than that which the entire body can furnish. However, from the design point of view the production of adequate heat within the pressurizing cabin is not an insurmountable problem.

The last effect of pressure changes, namely that of ventilation of the middle ear, is by no means the least problematic. It will be remembered that the middle ear is an air filled cavity vented through the Eustachian tube to the Nasopharynx, which is just above and behind the soft palate. During a rapid ascent with resulting decrease in pressure, the middle ear is nominally relieved through the Eustachian tube at regular intervals. This is accomplished by a soft membrane acting as a pressure relief valve and its action produces an audible click at intervals of about 425 ft for all ordinary rates of climb. If this pressure were to be released suddenly, the resulting decompression of the middle ear would have very little noticeable effect on the individual. However, in the process of ventilating the middle ear on descent, an entirely different problem is present. In this case the membrane closes off the end of the tube and attempts to keep the pressure low in the middle ear. To effect equalization it is necessary to mechanically clear the passage by swallowing, chewing gum or some similar means. This phenomena produces serious discomfort to sleeping passengers on airliners even though the rate of airplane descent is limited by Federal law, and further complications are introduced by passengers suffering from colds or other stoppage of the nose and throat.

The pressurization of the cabin of the plane seems to be the remedy for most of the ill effects encountered by the varying of atmospheric pressure in flight from sea level to 20,000 or 30,000 ft in a cabin so pressurized and at the same time adequately ventilated the dangers of anoxemia and aeroembolism are removed. Complete freedom of action is possible for the passengers and crew and the price to be paid for such advantages are mainly weight and increased cost due to design complication. Ingenuity in design can readily overcome the latter item leaving only an increase in weight as a limitation to be justified by the application of aircraft to specific service.

Assuming that a given cabin has been stressed to withstand the desired internal pressures and sealed to prevent excessive leakage, the equipment necessary to pressurize will consist mainly of a compressor, either engine or auxiliary driven and incorporating a weight flow control, and a valve which will permit maintenance of an internal cabin pressure higher than external atmospheric pressure and still provide an adequate ventilation flow. Additional safety precautions such as pressure relief and vacuum relief valves should also be included although these items present an infinitesimal problem compared with the design of compressor and pressure regulating equipment. Since the problem of design and manufacture of an adequate compressor has been undertaken elsewhere, the Aireserach Manufacturing Co. have concentrated their efforts on the production of an adequate and fully automatic cabin pressure regulating valve. The function which this valve must perform can best be illustrated graphically by reference to Fig 2. Here the unpressurized flight path is illustrated by an ascending straight line. At some predetermined

(Turn to page 124)

Courtesy United Air Lines

"GO AHEAD '41"

ALLOY NICKEL STEEL

Go ahead, '41! Speed up your schedules. Push up your horsepower. For those improved 1941 engines there'll be tuned-proved Nickel alloy steels to carry safely heavier loadings and withstand higher stresses.

During 1940—as in years past—the wear resisting, fatigue defying abilities of Nickel alloy steels were convincingly demonstrated by service in practically every aircraft engine built in America or abroad. Go ahead, '41. More power to you with dependable Nickel alloyed steels.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

Nickel alloy steels provide the improved strength and toughness required for aviation application. Notable advances have been made in using 1% chromium—5% Nickel type stainless steels in the construction of wing, tail and fuselage assemblies. Properly processed, these alloys combine excellent corrosion and fire resistance with high mechanical properties. Your inquiries regarding applications of Nickel alloyed metals are invited.

Automotive Methods

(Continued from page 43)

Therefore mass production may be defined as being the most efficient utilization of the human element. It can be accomplished by observing four requisites which may be developed in greater detail. Additional elements could be added, however, only the general considerations will be treated. The following are listed in sequence rather than in the order of their importance:

(a) Product Engineering
(b) Tool Engineering
(c) Cost Analysis and Regulation
(d) Production Control

There are many benefits derived by reduction and through the elimination of manufacturing variations. Namely, when guess work is removed, accurate timing and cataloging of work elements are possible and output predictions can be made.

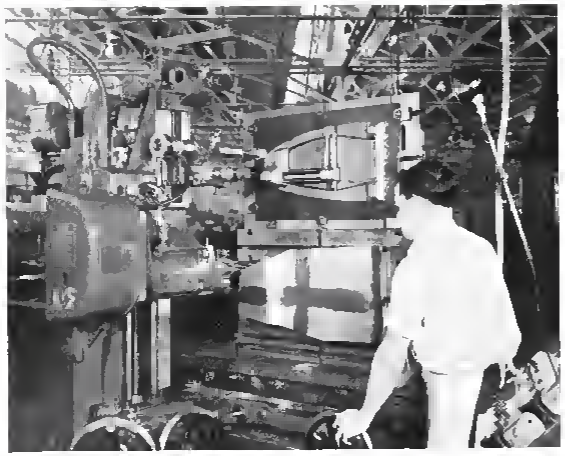
Interchangeability is the desirable product of reduced manufacturing tolerances that automatically eliminates the need for selective fits and the like which represent a definite limitation on output and control. These advantages can be obtained by special machine tooling and processing, but in the automobile industry mass production begins on the drafting board when the design is in an embryonic stage.

This suggests the first consideration in that it has been found advantageous to have design personnel familiar with machining and other factory processes. This treatment of the part is Production Engineering and is very closely allied with Tool Engineering and Costs.

It then becomes the problem of determining or establishing the extent to which the engineer in the development of a product is constrained to permit tooling methods and manufacturing processes to influence design. Unquestionably, in this regard, both engineering and manufacturing are vitally obligated in assuring the ultimate utility as well as achieving the most economical method of fabricating the product.

The importance of correlating the design of a product and the problem of providing tools for its manufacture, is not to be minimized. Oftentime the significance of this mutual responsibility has not been demonstrated or analyzed.

Engineering is basically concerned with the creation or development of a new device or product, or an improvement on one in current use, the design of which is dictated by certain conditions, trend of the art, sales appeal, improved durability, weight and strength requirements, some of which permit no deviation from prescribed specifications.

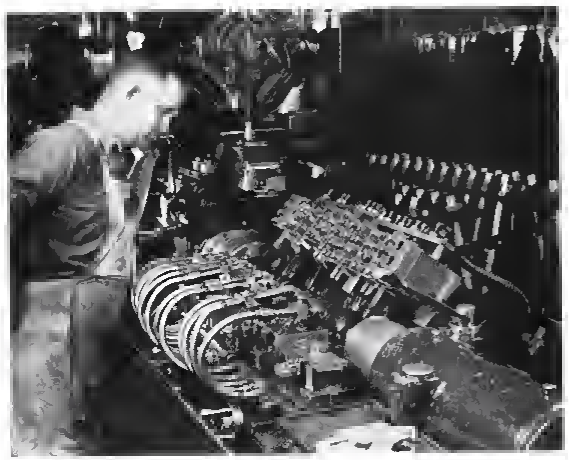


A logical step in the selection of production engineering is the Keller method of making experimental forgings for Prototype airplanes. The wooden template is at the top.

The project of tooling on the other hand, is that of utilizing wherever possible, available standard machine tools selecting, designing and providing suitable jigs and fixtures, assuring the maintenance of the specified degree of accuracy, and planning the manufacturing operations to obtain the lowest possible production cost.

Unless the product designer is familiar with manufacturing processes and production methods, the impression might be gained that the production

(Turn to page 144)



This single purpose machine tooling on landing gear cylinders and pistons eliminates the old lathe operations for turning the O.D. and boring the holes.

Letdown Procedure

(Continued from page 39)

set the Approach Guide indicates an altitude of 10,000 ft for the first crossing of the cone of silence. Of course a lower altitude may be used for the initial approach to the cone of silence, n terrain permits, but let us assume that, because of high mountains along the airway, the plane has arrived over the cone of silence at the indicated altitude of 10,500 ft. Selecting the safest legs of the range, with respect to surrounding mountains, the descent is started at 500 ft per min flying 120 m p h for 3 min to an indicated altitude of 9,000 ft at which point a standard 2-min procedure turn is made to reverse direction and return along the same leg of the beam. Setting the compass course of the radio range leg going out from the station automatically sets on the guide the course back to the cone of silence after the turn. For example, a course 260 deg out will show a return course of 80 deg back.

Assuming east and west courses with the airport 2 miles west of the station, the plane comes out on the west leg at 10 500 ft altitude. At 3 min out from the cone of silence a standard descending procedure turn will bring the plane back along the range on an 80 deg compass course to 6,000 ft altitude at the cone of silence. The pilot will then continue out the east leg on the 80 deg course for 3 min. to 4,500 ft. altitude where the second procedure turn is made, returning to the range on a 260 deg compass course and crossing the cone of silence on this course with the airport directly ahead. It will be noted that 2,000 ft altitude is reached 1 min before arrival over the cone of silence. There are several reasons for this. Normally a safe ceiling limit is considered at 1,000 ft and 3 miles visibility for day operations, and 1 500 ft and 5 miles at night. For such a night minimum it is apparent that this approach procedure will bring the pilot safely into the clear as he crosses the cone of silence and he can land contact. For day flying it relieves the pilot of the necessity of keeping a 500 ft per min descent and the last approach to the cone of silence, which is small at this altitude, can be made in level flight.

If the approach guide is being used by an airline with a somewhat lower minimum than the 1,000 ft. indicated here the pilot can continue his descent to the required indicated altitude.

The above outlined procedure brings the plane to the station flying west on the east leg. By assumption the field was located 2 miles west of the station

s the flight [illegible] on to the airport. In the event [illegible] landing equipment is to be used for the landing, the plane has been placed in approximately the correct position for the use of blind landing instruments by this method of descent.

Pressurized Cabins

(Continued from page 119)

altitude, for example 6 000 or 8,000 ft at which it may be desired to maintain the cabin pressure level, a horizontal line is drawn which intersects curves labeled 2.5 psi 3.8 psi and 6.5 psi. These three curves represent several assumed differential pressure limits for which given cabin structures have been stressed. Therefore, by following the unpressurized flight path to the 6,000 ft level for example, we find that this altitude may be maintained until a plane altitude of approximately 16,000 ft has been reached without exceeding an internal pressure of 3.8 psi in the cabin. Beyond 16,000 ft the cabin pressure must be maintained at a level which will not produce greater than 3.8 psi internal loading and therefore cabin altitude may follow indefinitely the curve labeled $\Delta P = 3.8$ psi. This will produce an 8 000 ft cabin altitude at approximately 19,000 ft plane altitude, etc. Actual cabin levels may thus be held within a predetermined range by utilization of the Airesearch Pressure Regulating Valve providing adequate compressor capacity is available.

In order to make possible the flight paths for cabin and airplane illustrated by Fig. 2 it is readily apparent that the pressure regulator must be able to control absolute cabin pressures until safe structural limits of the design have been reached and then to maintain a differential pressure beyond this point indefinitely in order to secure the maximum value from the unit. Of course we must presuppose that throughout the range of operation an adequate ventilating flow will be maintained in order to provide a constant supply of oxygen and to discharge the byproducts of respiration. The Airesearch Pressure Control unit is therefore divided into three major component parts so interconnected as to correlate these respective functions. The primary major part consists of the valve which restricts the cabin outlet and is actuated by an air motor piston or diaphragm. The movement of this primary major part is controlled by the two secondary parts which will be referred to as the absolute and differential pressure regulators in accordance with the nature of regulation each performs. The absolute pressure control consists of an evacuated sylphon which actuates a metering pin to regulate air pressure above and below the diaphragm. The differential pressure control consists of a piston and spring, which actuate a collared shaft.

The outlet valve controls the pressure in the cabin and at the same time gives a constant ventilating flow and is entirely self-contained and automatic in operation. The cabin altitude at which it is desired to start pressurizing may be present over a wide range of maximum cabin altitudes but it is a permanent calibrated setting. The operation of the unit can be divided into three phases. Phase 1 consists of its operation up to the desired pressuring altitude, during which period the valve is held in the full open position for maximum ventilating flow. Phase 2 begins when the evacuated sylphon has expanded sufficiently to meter the flow from the top of the actuating diaphragm, thereby regulating the position of the outlet valve. Phase 3 starts when the design pressure differential of the cabin has been reached and the differential piston over-rides the absolute control, permitting the upper side of the diaphragm to be vented to the atmosphere, thus producing an opening motion of the outlet valve and relieving excess cabin pressure. Through the action of a follow-up system and a series of bleed vents, the action of the outlet valve closure becomes instantly responsive to slight changes of cabin pressure and there is practically no lag to its operation regardless of violent maneuvering of the airplane. The present production valve has been proportioned to permit a maximum weight flow of 42 lb of sea level density air per minute since this amount fulfills the specifications of installations currently contemplated. Other sizes for smaller weight flows or dual installations will be made available as needed.

The adaptability of this control to either military or commercial applications is of notable interest. For example, military specifications generally will require maintenance of cabin level of, say 8 000 ft., to maximum operating height. However, commercial carriers may desire regulation between sea level and the 8,000 ft cabin level particularly to permit rapid descent at the conclusion of a scheduled operation. Fig. 3 gives a graphic picture of an airplane and cabin altitude flight path which can be achieved with a modification of the normal military type of control. The added electrical control would be of most value on sleeper planes where it would be advantageous to lower the cabin level gradually between normal (8,000 ft.) and either sea level or the altitude of the aircraft's destination.

To Sue or Not to Sue

(Continued from page 37)

etc, can be cut down to a minimum But the problem of low flying is still a major factor that must be taken into consideration and toward which a technical advance may be long in coming

As previously mentioned at the beginning of this article a suggested remedy for our problem was to make use of the city or community's zoning power But as was pointed out, zoning ordinances of that type have been held unconstitutional In the case of Mutual Chemical Co vs City of Baltimore, decided Jan 25, 1939, a zoning ordinance was passed in 1937 to the effect that "no building or structure may be erected whose height exceeds one-fifteenth of the shortest distance from the nearest side of said building or structure to the nearest established perimeter as distinguished from the boundary line of such public airport or landing field."

In other words, according to this zoning ordinance a landowner in the vicinity of an airport could erect upon his property, provided he were 500 ft from the airport, a building only 33½ ft high

The court however ruled that this zoning ordinance was actually confiscatory and took from a property owner a major part of his property rights, that since the zoning ordinance makes no provision for paying the property owner for the loss of these rights, the zoning ordinance was unconstitutional The court further states that just as it would be improper to obtain a railroad or bus station by means of a zoning ordinance, so would its use be improper to protect the life of an airport

A similar view was expressed in 1937 in an opinion by the Attorney General of Michigan on a statute limiting the height of buildings in the vicinity of an airport to a ratio of one to twenty to the distance laterally to the nearest boundary of an airport which is operated for airlines In fact it was upon this opinion that the Governor of Michigan, after the Act was passed by the Legislature, vetoed it

To make at this time any predictions as to how this problem will eventually be solved would be treading on ground where angels (and not aeronauts) fear to tread. As far as "spite fences" are concerned it seems that the Tucker and Bestecki cases, supported by the Thrasher theory will serve at least as a very definite deterrent to their erection for the purpose of interfering with the activity of an airport But what the remedy is when the obstruction steps out of the class of "spite fences" and can be connected with the beneficial enjoyment of the adjacent property, is a problem which only time will be able to solve

That this problem is becoming one of some importance is attested by the fact that on May 17, 1940, at a session of the Civil Aeronautics Authority in Washington, D C, the following regulation was passed to take effect on July 16th, 1940

REQUIRING THAT NOTICE BE GIVEN OF THE CONSTRUCTION OR ALTERATION OF STRUCTURES ON OR NEAR CIVIL AIRWAYS

Sec 1 Any person who engages in the construction or alteration of any structure located within 3 miles of the nearest boundary of any landing area along or within 10 miles of a civil airway, which structure or any part thereof is already or may become by reason of such construction or alteration of a height, above the level of the landing area, greater than one fiftieth of the distance of the structure from the nearest boundary of the landing area, shall, prior to the beginning of such construction or alteration give written notice thereof to the Civil Aeronautics Authority and to the manager or person in charge of such landing area *Provided*, That this regulation shall not apply to any structure which is less than 5 ft in height above the level of the landing area

Sec. 3 As used in these regulations the terms "landing area" shall mean any landing area as defined in section 1 (22) of the Civil Aeronautics Act of 1938 which is equipped for the operation of aircraft at night or which has a landing surface at least 2,000 ft long and at least one permanent building devoted to aeronautical purposes

Although this regulation does not in any respect attempt to control the height or the manner in which the structure is to be constructed but merely requires that the authority receive notice of such construction still it clearly indicates the dire necessity of some type of regulation or control over the height of structures near and in the proximity of airports It may be that the Civil Aeronautics Board may find some solution to this problem but it is needless to add that the C A B is as much controlled by the United States Constitution as the individual State Supreme Courts are Just as there are numerous ways of skinning a cat, so there is probably a number of possible solutions to the problem at hand What the ultimate solution will be, and on what theory the solution will be based, we can now only leave to the ever-flowing sands of time But whether it be by intuition or by hunch we strongly feel that the ubiquitous phrase "general welfare of the public" is certainly destined to play in the near future a major role in the final solution of our problem.

Honing Engine Parts

(Continued from page 57)

diameter x 3½ in. long, are honed in the fixture shown in Fig 4

Tandem knuckle pin bores, approximately 1.058 in to 1.064 in. diameter x 1.094 in long each, and 1½ in. apart, are honed in the fixture shown in Fig 5

The wrist pin bores in the master connecting rod, and in the articulator rods, each approximately 1.535 in diameter x 1¾ in. long, are honed in the fixture shown in Fig 6

Other Miscellaneous Bores

Impeller shaft bearing cage (rear) bores, approximately 1.375 in diameter x ⅜ in. long, supercharger rear housing sleeve bores, approximately 2.181 in diameter x 1 3/16 in. long, impeller shaft front bearing liners, approximately 2.250 in diameter x ½ in. long, and crankcase front section sleeve bores approximately 3.490 in diameter x 1⅝ in long, are all honed in one fixture shown in Fig 7

A sleeve bore, 4.8125 in diameter x 3/16 in long, in the crankcase front section assembly, is honed in a somewhat similar fixture Other bores, all in unit or assembled parts, are honed in another fixture These parts are as follows supercharger front bearing sleeve bore approximately 2.1875 in. diameter x ½ in long in the impeller shaft bearing support assembly, crankcase front cover sleeve bore, approximately 3.500 in diameter x 5/16 in long, in the crankcase front cover assembly, cam drive gear oiling bracket bore, approximately 4.4375 in diameter x 1¼ in long, in the cam drive gear oiling bracket assembly, stationary reduction gear bores, approximately 4.8125 in diameter x 2⅜ in. long, fixed reduction drive 4/3 gear, bore approximately 3.625 in diameter x 1 3/16 in long, fixed reduction drive 3/2 gear bore, approximately 4.218 in diameter x 3⅞ in long bracket oil feed liner bore, approximately 4.500 in diameter x 5/16 in. long, in oil feed bracket and liner assembly, bracket oil feed liner bore, approximately 4.500 in diameter x 29/32 in long, fixed reduction drive 3/2 Gear bore, approximately 4.500 in diameter x 1 in long fixed reduction drive 3/2 gear bore, approximately 4.500 in diameter x 1½ in long, thrust bearing cover liner bore, approximately 5.125 in. diameter x ½ in long, in propeller thrust bearing-cover-ring-liner assembly This type of honing equipment should prove of great value to maintenance men in the future

National Defense Program

(*Continued from page 33*)

or two for one. This can be done by proportioning properly the deliveries of trainers that we first need and the combat planes that England desperately needs. When doing this, it is believed we can still, under anticipated production delivery schedules, *meet the minimum aviation directive requirements set up by our General Staff*. As a two-ocean Navy will require several years to attain, and as satisfactory naval security the while is so intimately tied up with the sea forces of Britain, our own defense is obviously best served by augmenting Britain's Navy by additional Destroyers and other types of vessels as needed. There are surely other needed naval base leases or outright land acquisitions for which these can and should be "traded"! There is no better use to which they can be placed.

In addition to aid to Britain, we must more rapidly expand and better organize and coordinate our own defenses. These include the forces of the land, the sea, and the air.

Land Forces

We undoubtedly need a substantial increase in our land forces, but it should be appreciated that the use of these expanded forces will only materialize if our Navy and air forces are unsuccessful in denying an enemy a foothold from which to attack us by land. Our government and our people are committed against sending troops abroad and no contingency requiring a change in this policy is either imminent or appears likely. So, although greater speed is always desirable, nevertheless, what we are doing and contemplate doing for our land army appears adequate, although this is for experts in this field to judge.

Sea Forces

A two ocean Navy program is under way. The Navy is still our first line of defense, but as previously explained, it will take time to expand it, much time, so that until our two ocean Navy exists, any adequate sea defense must depend on cooperation with England. With England victorious, and with continued understanding with her or, better still, some form of alliance, a two-ocean Navy will be unnecessary and one of present dimensions more moderately increased, will suffice.

Air Forces

But what of the air? Here we have only begun even to envision our goal. This new medium offers possibilities of defense so far most inadequately conceived. Here too, is our surest means of aiding those who stand between us and those who wish us ill. As only airmen now appreciate, but as others are dimly perceiving, the Air Force will soon be the first line of defense and as well, the striking power of the future. We must build it more rapidly.

Defense Coordination

We have a final basic defense problem, beyond our expansion needs and additional to the necessity of aiding Britain. This is one of policy, involving organization and coordination. Can the weapons of our defense arms be used most effectively when in separate services, coordinated only by an overworked President and Joint Army-Navy Board? Boards and Committees are usually poor substitutes for centralized authority. Is not a Secretary of National Defense indicated? A cabinet officer in addition to the Secretaries of War and Navy? Under his immediate control might well be placed some of the coordinating functions of the National Defense Advisory Commission.

Air Power

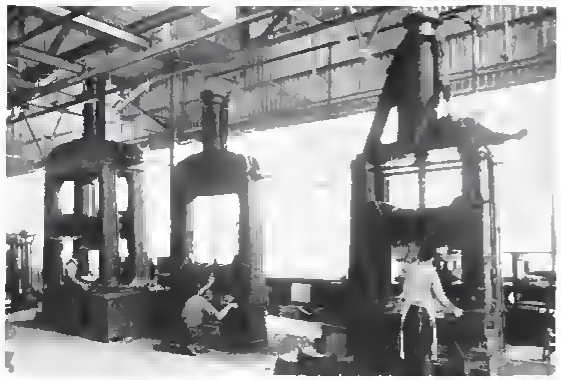
Again, is not the present importance of Air Power, and its future pre-eminence so certain as to warrant its establishment as an independent striking force, with a cabinet secretary to head it up reporting also to the Secretary of National Defense? The independent air arm would, by such a scheme be the air striking force and would in no way conflict in duty with the Air Service of the Navy or the Air Cooperation Units of the Army working directly with those branches.

This problem was rife in England during the First World War. In the plans outlining the permanent organization of the Royal Air Force in 1919 Air Marshal Sir Hugh Trenchard said: "The principle to be kept in mind in forming the frame work of the Air Service is that in future the main portion of it will consist of an Independent Force together with Service personnel required in carrying out Aeronautical Research. In addition, there will be a small part of it specially trained for work with the Army, and a small part specially trained for work with the Navy. These two small portions probably becoming, in the future, an Arm of the older Services. It may be that the main portion, the Independent Air Force, will grow larger and larger and become more and more the *predominating factor in all types of warfare*."

Our Naval Air Service is the finest in the world, but it is a part of the Navy, working always with the fleet and except for patrol planes, is based on sea going vessels. It can and should remain so unchanged *even in procurement organization*, and thus in no way conflict with such an independent striking force of the air. In short, it should remain unchanged.

These matters of policy and organization are discussed as items requiring the immediate attention and consideration which their importance warrants. It seems to me that the case for an Independent Air Force is strengthened

(*Turn to page 132*)



Special equipment, such as these air hammers, must be installed in the production work on airframes.

(*Continued from page 130*)

when consideration is given to the problem from another point of view. The medium in which fighting planes operate also supports vessels of transportation. Thus, air power, composed of military air force and commercial air lines, is analogous to sea power, with naval strength and merchant ships. Air power consists of more than weapon carrying airplanes, an extension of artillery. It implies air control, commercial and military. As such, it is going to require a place in our scheme of things, comparable in importance to sea power. From this point of view we must be careful that we allow our air lines to expand as much as practicable, as their value to us is of vast and increasing importance in performing their transportation function.

I was struck by the aptness of a statement by Walter Lippman, a layman in aviation matters but a keen analyst, when in a discussion of this problem he said "Surely our experience of human nature tells us that the utmost potentiality of a new weapon is not likely to be developed by men who think of it as an auxiliary to the older weapons. ... Only an Air Force has the range, the mobility and the offensive power to compensate for the insufficiency of our one-ocean Navy and the extreme slowness with which an Army can be brought into action. ... The area we have to defend is enormous."

After much reading of pros and cons, considerable analysis and some reluctance as change now may be upsetting, I have come to the conclusion that our Government should reconsider these problems of policy and organization and find the means, with the least disturbance to existing agencies, of creating an independent Air Force and a Department of National Defense.

Aircraft Production Problems

The pictures accompanying this article show examples of several of the *Army and Navy types of airplanes* that are being procured currently. In many instances, there are other models of the same types being procured. There are 12 or 14 distinct types required by the Army and a like number by the Navy. Altogether, there are about 45 models, representing distinctly different airplanes, in the present program. There are several models developed especially for the British, differing entirely or substantially from those produced for our own Services. Thus, our aircraft industry is at present producing about 50 differing military models. Attempts to standardize are under way and will succeed in improving the situation by reducing the number of models somewhat. However, the diversified and specialized military uses of aircraft are such as to make it unlikely and probably impossible to reduce the number of models to less than 40, or possibly 35, without seriously affecting military efficiency. These facts must constantly be borne in mind when appraising production problems.

Simply stated, our problem is to produce the greatest number of military airplanes in the shortest possible time. The graph of Fig. II illustrates the magnitude of the task. The *yearly outputs* shown are less than desired but are reasonably certain of attainment. This shows a 1944 production nine times that of 1940 which, in turn, is five times that of 1936: a good record and a creditable program—but not enough. The anticipated 1941 production of 19,500 planes is greater than indicated by the trend curve because of a larger proportion of training planes then scheduled than will normally maintain. Otherwise, the trend curve represents about what I feel may be expected. It can be further improved if the effort for "total defense" is as great as this article pleads it needs to be.

In Fig. III is shown a curve of anticipated *monthly deliveries* of airplanes on current programs. Early decisions will have to be made on further orders if we are to cause the monthly deliveries of 2,500 reached in April 1942 to be increased thereafter without the flattening shown. This curve shows the deliveries of complete airplanes and does not include spares which for air-frames, represent an average increase in required productive capacity of about 20%. *The rate of increase shown starting January 1941 is greater than at any period for either Germany or England.* It is, I fear, not likely greatly to be exceeded, especially when considering that the bulk of new factories situated away from present locations are yet to be built and completely equipped.

Expansion requirements, including factory floor space and labor force, for the production deliveries of Figs. II and III, just described, are shown in Fig. IV. To get to an objective of 50,000 planes a year, present productive floor space for producing airframes must be increased from 14,000,000 to 40,000,000 square feet, with 28,000,000 square feet at a capacity production in May 1942, when planes of present orders are at peak deliveries. The corresponding size of the productive labor force for the three periods are respectively, 120,000 and 400,000 and 280,000. Corresponding figures for the engine and propeller industry are shown. Counting in instrument and equipment (but not armament) factories, and adding in total non-productive floor space and personnel, we find that the aircraft industry, to produce 50,000 military airplanes a year will require about 90,000,000 square feet of floor space and 800,000 employees.

The mere expansion of factories and numbers of workers is thus seen to be a tremendous task, subject to many difficulties and possible hold-ups. But this is but part of the whole problem. Another such part is the equipping of the factories with *machine tools*. Training the labor force required in the time allowed can only be accomplished if, as indeed is intended, we use true "production" methods of construction, which contemplates use of large, expensive and accurate machine tools and special tooling. The accompanying pictures of tools currently used in the airplane industry are shown to emphasize the size of machine tools needed—intricate jig borers, 5,000 ton presses and high capacity air drop hammers. Many more standard tools such as lathes, automatics, millers, drill presses, grinders and shapers are needed in great quantities. These take time to produce and threaten to be another serious bottleneck.

I mentioned before the great number of models of airplanes required by our Air Services, 40 to 50. Thus for a 50,000-planes-per-year program, the average yearly production for any one type will be about 1,000. A few types which are required in the larger proportions of the total will reach perhaps 4,000 a year, or approximately 15 per day. Several *automobile* companies are capable of turning out up to 2,000 units each day. So the airplane industry, in terms of potential mass production is of the order of one percent of the automobile industry. Different methods, particularly of assembly, must therefore be expected. True production methods however are used now and will be used increasingly as time goes on. It is a disservice to the country, however, to mislead those not aware of these facts by giving out rash statements on "1,000-per day" airplane production rates as these are unattainable by great motor car producers, or any one else. The management of our large aircraft companies appreciate the magnitude of their problems and welcome constructive assistance from competent personnel of other industries, skilled in producing units in larger quantities. The introduction of new methods must, however, be made gradually and only after careful analysis to insure a net resultant gain and avoid the danger of an actual slowing up of deliveries by over-tooling.

A final expansion problem, perhaps the most difficult of all, is expanding

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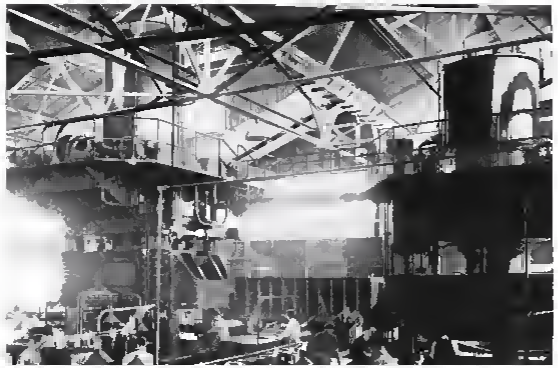
management itself Here the thinning out process has the greatest inherent dangers Here the only training sure of results is experience, unattainable in the time required So men must be brought up from below to positions of greater responsibility, others brought in from other industries and trained in matters peculiar to aircraft production and the talents of those now at the top spread out over a wider field This is a task of tremendous magnitude

A further production problem is that of *quality* This refers both to insistence on high standards of workmanship, material and finish, and to design excellence from the standpoint of performance, armament installation and general military usefulness The first type of quality must be maintained at a high level as imperfections acceptable in mechanisms less highly stressed than the airplane and its engine where weight saving is of paramount importance, will in this case cause disastrous results Perhaps the severity of some specifications can be reduced, particularly in finish requirements, but in general, it is not believed wise to "let down the bars" a great deal, if at all There is a need however for avoiding delays brought about by duplicate government and company inspection Supervisory inspection only, on the part of the government should exist

The really difficult quality problem in an industry based on a rapidly developing art is ever to get true large quantity production of a product that always requires optimum *design excellence* There is no more important factor in raising and maintaining the morale of the fighting forces than continuously justifying their realization that the planes they fly have the edge" on their opponents Reports from England consistently emphasize this fact The marked superiority in the Fighter Class of England's Supermarine "Spitfire" and Hawker "Hurricane" both with eight .303 calibre wing-mounted machine guns, and of the Vickers "Wellington" and other bombers equipped with power operated machine gun turrets over planes of their German adversaries, accounts in part for the superlative morale of the young pilots of the Royal Air Force, who have saved the day for Britain (and as well, for Civilization) This striving for design superiority necessitating introduction of changes for performance improvement, with fairly frequent shifts to new models, automatically sets a limit on production quantities that may be released. But as production in even the quantities that may be released requires time for tooling and for proving planes initially delivered, we have a corresponding restriction on the design



Large presses of this type necessary in aircraft production work, cannot be moved into an empty factory overnight.

quality of service aircraft. Unfortunately, we can never have 'to-morrow's airplane to day" (or even "to-day's best design to-day") in service squadrons This rapidly advancing art makes it necessary always to fight with semi-obsolete equipment This indicates the tremendous importance of continuing research and development even in war time so as to approximate the Ideal, or at least surpass the enemy in the planes doing the actual fighting.

The above discussion will, I believe, show the extent of the problem confronting procurement agencies in setting a program and placing orders Each order of combat planes must be large enough to permit efficient production, but not so large as to force too obsolete equipment on service squadrons towards the end of the production run As the normal-time procedure consisting of prototype development, service test in small quantity, then production requires three or four years, there is a temptation, and in fact real need, to short-cut by initial "quantity ordering from blueprints" This places a tremendous responsibility on and presupposes a supreme confidence in the design staff's ability to achieve an original success In practice, a 50 per cent record of success is good The requirement of flexibility of any organization, by the existence of which changes can be introduced without undue disruption (changes necessary frequently because of experience gained in war service) makes it highly desirable for the parent company that has developed a design to retain control throughout its production. This, in turn, makes it necessary to increase production capacity either by expansion of the parent company itself or through subcontracting by it. The straight licensing of designs without close subsequent parent company contact, particularly in the case of airframes, is not recommended and was proved costly in terms of time in England

Another problem of *procurement agencies* is so to plan the placing of orders for the various types as to obtain deliveries in the proper sequence Trainers must be in service ahead of tactical type so as to provide sufficient pilots for the latter when deliveries are made

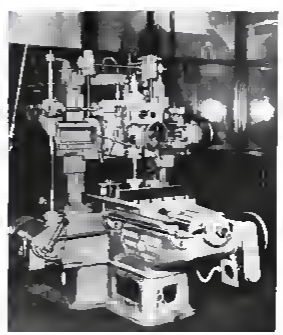
There has been much recent discussion of the matter of *hours of labor and shifts* For maximum economy, a five day week with three shifts each day and with a Saturday overtime day for balancing production, appears best It has so far been found difficult to work effectively more than the equivalent of two full shifts in the nominal three 5-3 2 shift ratio is good with probably a 5-3½-2½ a maximum This whole scheme can be pushed up to a six day week with Sunday on which to balance up production, even though the retarding effect of fatigue may reduce efficiency However, productivity, of such immediate importance, would be increased by this expedient so that with tooling completed and bottlenecks eliminated elsewhere, such work week should be made the rule Many firms work two 10½ hour shifts each day which is believed to be a less efficient and certainly an uneconomical scheme It requires a greater cost to accelerate delivery and has other social and economic effects which do not commend it

Then we have the problem of *material shortages* One must view with concern the situation in the steel industry where a 97% capacity production is

reached at a time when production expansion is only just getting started. No basic shortage of aluminum is forecast although time between placing of orders and deliveries is from three to nine months now. Bottlenecks in forgings and castings, particularly magnesium in the latter case, are appearing and require attention. This all points to the need of effectively organizing priority boards with authority to handle each class of material in which shortages are imminent. Such boards must cover priority ratings for deliveries both between defense and non-defense industries and for individual cases within defense industries.

The problem of attaining *balanced production of airframes and engines* is most difficult. As our major expansion program started to get under way, we had a condition wherein the aircraft engine industry was considerably nearer its capacity than were the airframe companies. Coupled with this is the fact that it takes substantially longer to expand engine production than airframe production. Some indication, or measure of this disparity is the cost of new facilities for the two industries: engines approximately $20 per square foot of productive floor space (including tools) and airframes $8 per square foot. Thus, a serious bottleneck in engines has already been encountered and will for some time persist. Then too, an engine as part of the airplane must be delivered to the airframe factory for installation, 30 to 60 days in advance of the airplane delivery. A further factor that has increased the trouble is the delivery abroad of many engines for installation in foreign built airframes. Such bottlenecks seriously retard airplane deliveries as an airplane will be held up both by a falling down in airframe production or a deficiency in engines. Propellers are in an analogous condition to engines. A further factor to be considered when studying expansion requirements in the engine and propeller industries is the need for spare engines (in addition to engine spare parts) coupled with the fact that many airframes require more than one engine. Actually, there are just over two engines required for the average military airplane.

These then are some of the aircraft industry's problems. Close cooperation and well coordinated effort by all involved is necessary. Perhaps a Coordinator of the industry, a suggestion recently made, is necessary. Perhaps more authority in the National Defense Council. The proper answer must be found.



Intricate jig boring machines must be operated many hours in the process of tooling up for mass production work.

The 50,000 Planes-A-Year Program

Last May, as the Germans started their blitzkrieg in Holland, the President announced the famous 50,000 Planes-A-Year Program for the United States and a little later the Advisory Commission to the Council of National Defense was formed. For some strange reason, at the outset, the Treasury Department was delegated the authority to supervise the aircraft production effort and a meeting with representatives of the industry was called. The enthusiasm to proceed on the job was shaken by this conference, which proved to be a fiasco, as no adequate preparation for the meeting or plan of procedure for coordinating a program with the industry had been worked out. I am listing this and some of the following items which were obviously errors, not in the spirit of criticism, but in the hope that consideration of them may obviate repetition of these types of mistake in the future wherein our effort and our difficulties will be far greater than any we have yet known.

There follows then, a discussion of the things that caused *delays and inefficiencies* in translating the "50,000-Planes" announcement into a program, then the program into orders and finally the orders into man-hours of labor exerted in production of the desired airplanes.

The *first* trouble was the failure to clearly *define the objective*. Was it intended that a total of 50,000 planes was to be produced in some period of time? Or was it desired that an industry capable of producing 50,000 planes per year be built up? Or both? And, in each case, in what time? The first actual program produced called for the production of 50,000 planes in four years. It was found that this was not what was wanted so it was scrapped and another program laid out, somewhat in excess of General Staff and Navy Department requirements, but not equalling a 50,000 planes-per-year industry objective. A couple of weeks were lost in the re-shuffling. The lesson should be that plans must be more clearly thought through and more specifically stated at the time of initial announcement.

Second, there was the inevitable *interference* between agencies charged with doing about the same thing. Thus a National Defense Advisory Commission was superimposed on the military services, already completely organized to do the job. Additional conferences, discussions and approvals were required with the personnel or this new agency, obviously entailing added time. The existing technical, planning and procurement agencies of the Army and Navy could not move without such consultations and yet there seemed to be no clearly defined authority delegated to the National Defense Advisory Commission to direct action which should be taken. Incidentally, a new organization meant new reports from the industry superimposed on the existing ones theretofore demanded by the Treasury Department and the comprehensive ones worked up through the years by the procurement agencies of the services. Perhaps a small point, but nevertheless it was another burden for a confused industry to bear.

As might be expected, there was some *faulty organization* within the hastily formed National Defense Advisory Commission. There was some incompetence. And there was some lost motion occasioned by the necessity of physically separating the offices of personnel within the various divisions. The industry was not advised with regularity and clarity as to what was going on. Consequently, as time went on with no very tangible results, the manufacturers grew restive, and lost much of the enthusiasm that they had at the outset. It is however, important to note and to emphasize that neither in the Defense Commission nor in the Service departments has there been any lack of good intentions or hard work.

Fourth, there were the delays occasioned by debate in Congress and then passage of the *laws and appropriations* essential to permit any actual work to proceed. A Democracy must and should allow time for thorough discussion of such matters but in this case there was undue delay in many instances, with insufficient realization of the overshadowing importance of time in the present emergency. The following legislation was involved:

1—Authorization to procurement agencies to purchase on negotiated contracts in

lieu of competitive bidding, an essential change for saving time.

2—Legislation lowering then raising then eliminating the profit limitation provisions of existing acts (Provision was also made for procurement on the basis of cost plus fixed fee contracts)

3—Passage of appropriations bills to permit placing actual contracts (Two political conventions with recesses of Congress intervened in this debate, causing some three weeks of delay)

4—Lengthy discussion of the method of computing plant amortization finally resulting in the sections on this subject in the Excess Profits Tax Act.

5—Provision for facilities contracts involving payment for construction of Defense factories. And alternatively, authorization in procurement contracts for facilities allowances in unit prices

6—Authorization altering existing laws governing working hours to permit accelerating deliveries

7—Establishment of Export Control Procedure. (This involves a very cumbersome setup requiring approvals by the President's Liaison Committee, the offices of the Assistant Secretaries of War and Navy, the Clearance Committee of the Army Navy Munitions Board and the Defense Advisory Commission)

8—Establishment of the rules governing funds for expansion of industry acquired from the Reconstruction Finance Corporation or private sources

9—Finally, there was the Excess Profits Tax applicable to all industry containing provisions as its name implies superseding the profit limitations requirements of previous legislation (affecting the aircraft and shipbuilding manufacturers only) and also containing rules governing amortization of funds for defense expansion and facilities contracts closing agreements

A *fifth* cause of delay was the *conservatism of the industry*. Desiring at the outset to "roll up its sleeves" and get to work, through the summer its ardor was dampened and it became restive and suspicious. The items listed above caused doubts to arise as to the sincerity of the Government on the whole program. But in spite of probable justification for this feeling from a strictly *business* standpoint, there was far too much worry, from a *National Defense* point of view, concerning conditions which would maintain after the emergency. There was no real general appreciation of the peril of our situation or of the need for sacrifice of normal sound-business principles-procedures in creating "total defense", both adequate—and in time.

In fact, it was quite late in the summer before even Government officials commenced pointedly to indicate to industry that normal conditions and procedures are incompatible with those existing in an emergency. This is well illustrated by quotations from three speeches of Mr Knudsen. In the first, he described the National Defense Advisory Commission policy at the outset—"We decided to superimpose the defense load on the regular business load of the country in order first to take up the slack and then adjust it if necessary." On October 15th, apropos of the machine tool industry, he said: "If you gentlemen figure you are going to need a lot of machine tools in order to carry out your American way of life, you had better take another look." Then, on December 13th, to the National Association of Manufacturers, he said: "It is our responsibility to see that this is done in record time and that we proceed right here and now to show the world that we can do the things that we have been so wishfully forecasting the last six months. . . . Isn't it possible to put the defense job on a war basis even if we are at peace?" A distinctly changing point of view!

All of the many controversies that strung out through the summer were of course made more bitter and the people were more confused because of the *presidential campaign* throughout the most critical stages of the program development. Here, industrialists often found themselves in the anomalous position of wanting to facilitate and cooperate with all national defense efforts simultaneously with expressing opposition to the Government!

It all adds up to quite basic *inefficiencies in democratic government* which we cannot now afford and must eliminate. Red tape must be cut, suspicions must be allayed, action must be based on expert knowledge, organizational conflicts in jurisdiction must be remedied, courageous action must be taken, not slowed up as sometimes occurs by fear of subsequent congressional investigations, policies must be clearly stated and the people given accurate information. Some of the efficiencies of direct line authority in government can well be borrowed from the totalitarian countries—but retaining the while our fundamentally democratic outlook on human rights.

The Program

By the middle of October, a program had been converted from talk to contracts. Five precious months had passed doing a job that could conceivably be done in half the time—and "money cannot buy yesterday". But even the final program, implemented in part by contracts and facility expansion authorizations was not the one which the President envisioned when on May 16th he said: "I should like to see this Nation geared up to the ability to turn out at least 50,000 planes a year. Furthermore, I believe that this Nation should plan at this time a program that would provide us with 50,000 military and naval planes." The present contracts, including commitments to the British, point to an Army Air Force of about 18,000 planes and for the Navy of about 7,000. Instead of completing the construction of approximately 40,000 planes (15,000 for the British) by the Spring of 1942, the date will be in the Summer of that year, and instead of attaining an industrial capacity by that time of 40,000 planes a year, it will be about 30,000. Thus, the 50,000 plane Air Force and 50,000 plane-per year industrial capacity is far ahead of us and present programs must be greatly augmented to achieve these objectives.

Work is now actively in progress on plans for new programs to augment the present one, partly based on a more active participation by the automobile industry. Plans for building plants to produce more two- and four-engined bombers are being made. But let us not be too sanguine of early results. Alfred P. Sloan said in November: "Unfortunately, little is available for our most vital defense needs (airplanes, airplane engines, and ships of war). Plants for the production of peace requirements have scarcely any adaptability to defense necessities. The American industrial machine is not designed to produce the things that are now most vitally needed. And little flexibility exists. That is inherent in our system of mass production."

Even while stating and fully appreciating the severity of the problem, I am sure that we can do a better job than was done before.

Air Strengths

In a previous article (appearing in the April, 1940 issue of AVIATION MAGAZINE) I showed charts based on estimates of the *relative air strengths of the Allies and Germany*, both as to productive capacity and total air force. These were pre-blitzkrieg estimates, requiring revision now for changed conditions. Since then, Italy has joined the conflict, France, by defeat, has left the Allies, the United States has accelerated its production and its deliveries to England, and plane losses, both "in the air" and "on the ground" have greatly increased. The revised estimates are shown in Fig. V (for monthly deliveries) and Fig. I (for Total Air Force). As before, Total Air Force includes all types of planes, proportioned approximately as follows:

First-line Combat (Fighters, Bombers)	30%
Cooperation Planes (Reconnaissance, Cargo, Observation, Utility)	15%
Reserve (all Tactical Types)	25%
Training Planes	30%

It will be noted that *equality of production rate* of deliveries for the adver-

(*Turn to page* 138)

(Continued from page 136)

sarles is estimated for the middle of 1941 as against the first of 1940, pre-blitzkrieg conditions *Equality of Total Air Force* is estimated for the Spring of 1942 as against the Summer of 1941 under conditions of the first half of the War The entry of Italy and the Fall of France weighed heavily in Germany's favor But Germany's disproportionately large "total war" air losses and the larger shipments to England from the United States have partly counteracted this gain In the initial all-out attack on England, German plane losses were three times those of England, and personnel five times (average of the first eight weeks) This disparity is now less, but the losses are still substantially greater for Germany and, including Italy in the picture, will continue so Fig V assumes that the 3 1 ratio will reduce to 2 1 by July 1942 Ground losses for the two adversaries are assumed equal at 20% normal capacity reduction, Germany's greater destructiveness seeming to have been more concentrated on non-military objectives as opposed to England's contrary policy Here again, Italy's entry into the war has affected England's industry practically none, whereas her own losses have been extensive

Assuming fairly close approximation to the truth in these curves (and I can claim no more), we see the tremendously important part played by our plane deliveries to England. If we meet or improve the rate shown, England will win

Conclusion

Starting with a discussion of the conflict in philosophies between the democratic and the dictator ruled nations, and a review of the rise of aggression as a basic policy of totalitarian states, I have attempted to define the defense fundamentals, psychological and material, which must prevail with any nation if it is to meet total aggression with total defense Our particular defense problems are next outlined Then, concentrating on aircraft production, our program and efforts at expansion are discussed with the object of eliminating future errors by stating past ones

We have before us constantly the spectacle of a war, brutally waged and directed indiscriminately by the Axis powers against combatants and noncombatants against ideals, and against the whole philosophy of democratic institutions. We are seeing daily the glorious stand of England with her few allies, fighting with undaunted courage What more courageous epics has history to offer than those we have witnessed: the defeat of the Graf Spee by out-ranged British Cruisers; the miracle of Dunkerque, where a whole people rose to save its fighting men from a hopeless situation; the calm courage of the common people of London, arising daily from their air raid shelters to find their homes destroyed, and grimly planting little placards in the smouldering ruins, reading "There will always be an England", the stand to the end of the Jervis Bay, unarmored and out-gunned, defending and saving most of its convoyed ships and finally, the Royal Air Force, whose boys willingly and smilingly engage in combat any number of enemy planes and without regard to the odds These boys, fighting the good fight for civilization deserve all we can do, with whatever increase in sacrifice that may be required, to furnish them planes to continue their fight With such help, they will win. Winston Churchill says of them "Seldom has it been the privilege of so few to do so much for so many."

Let us then do the things "short of war" necessary to insure England's victory and our own security As this involves a bigger production of planes, and shipment to England of a bigger proportion, let us do both If it involves change in legislation to permit loans, let us do that, if outright cash gifts then even that, the "barrel head" on which we have required funds to be placed cannot much longer be covered by money! Our way is easy compared to theirs, whose lot was so clearly given by Churchill when he told the English people during a speech in Parliament "We have before us an ordeal of the most grievous kind—I would say to the House, as I said to those who have joined this Government I have nothing to offer but blood, toil, tears and sweat"

Let us assume some courageous part in this fight for democracy, taking such steps as we must to make ourselves efficient for the tasks ahead, always realizing the need of retaining our fundamental rights In 1938, President Roosevelt well expressed this need "Democracy in order to live must become a positive force in the daily lives of its people It must make men and women whose devotion it seeks feel that it really cares for the security of every individual that it is tolerant enough to inspire an essential unity among its citizens, and that it is militant enough to maintain liberty against social oppression at home and against military aggression abroad"

Finally, let us look beyond the present war to a closer union of nations As de Tocqueville said long ago "When men feel a natural compassion for each other's ills, when easy and frequent relations bring them every day closer and no susceptibility divides them, it is easy to understand that at need they will mutually assist one another The moral force inherent in a sympathetic understanding between the two great English-speaking peoples is of inestimable worth" Backed by preponderant Air Power, this force for peace will be enduring

Window Shopping

Rapid acceleration of aircraft production rate has placed new pressure on every part of the aircraft industry More than ever before there is need to keep abreast of new developments through current trade literature All of the publications listed may be obtained by the reader by writing direct to the firms listed

Air-Safe Aircraft Instruments—A four page folder listing a line of deluxe aircraft instruments including all temperature gauges oil and fuel pressure gauges, and vane and moving coil type ammeters. Air Safe Aircraft Instruments 1933 N Western Ave., Hollywood, Calif.

Salt Bath Furnace—A 20 pg Catalog No 107 giving detailed data on furnace equipment and on heat treating applications. Ajax Electric Company Inc. Frankford and Allen St., Philadelphia Penna.

Aluminum News Letter—A monthly publication bringing current information on aluminum developments. Aluminum Company of America, Pittsburgh Penna.

Tuckerman Optical Strain Gage—Bulletin 2084—An 8 pg folder describing this equipment and testing work done with it including especially aviation applications. American Instrument Co 8010-8020 Georgia Ave. Washington D C

Bakelite Review—Monthly houseorgan of the Bakelite Corp., this publication is always fascinating for its bright colored plastics and novel applications to various products Bakelite Corporation 30 East 42nd St., New York N Y

Bakewell Pressure Tapping Machine—This 12 pg catalog describes in detail a machine developed especially for precision aircraft production work, and which is finding wide application elsewhere as well. Bakewell Manufacturing Company, 2427 E. 14th St., Los Angeles Calif

Bowser Aviation Products—A series of Bulletins are available covering airport fueling systems and accessories S F Bowser & Co Inc., Fort Wayne, Indiana

Marvel Shields—A 4 page folder describing a combination magnifying lens shield, and light fixture which is being widely applied to aircraft machines and inspection uses The Boyer Campbell Company 6540 Antoine St. Detroit, Mich.

Bunting Standardized Bearings—Catalog No. 40—Lists industrial bearings electric motor bearings, graphited oilless bearings, precision bronze bars, babbitt metals. The Bunting Brass & Bronze Co. Toledo Ohio.

Rex-Flex Stainless Steel Flexible Tubing for Aircraft Applications—This 8 page catalog lists a complete line of flexible tubing developed especially to meet aircraft needs. Chicago Metal Hose Corp., Maywood Illinois.

Copper & Brass Research Association—Bulletin No 112—Lists progress in industrial applications of brass and copper Copper & Brass Research Association 420 Lexington Ave. New York N Y

In Case of Fire—C-O Two—An 8 page 2 color illustrated booklet describing a complete line of carbon dioxide fire extinguishing equipment C O Two Fire Equipment Co, Pyrene Building Newark N J

Despatch Tempering and Drawing Furnaces—Bulletin No 83—A four page folder of interest to everyone requiring machine tool and die furnaces. Despatch Oven Company Minneapolis Minn.

Precision Bearings Engineering Catalog—A complete bearing catalog giving dimensional and tolerance data on Bower Tapered Micro-Honed Roller Bearings and Rollway Roller Bearings. Precision Bearings Inc. 1706-08 So Grand Ave., Los Angeles Calif

Development of A Plastic Molded Airplane

(Continued from page 45)

synthetic plastics shows that for complex aircraft structures thermoplastic may be more practically utilized than the thermosetting plastic for the following reasons

1 Temperature of not more than 240° F is required to soften thermoplastic, whereas thermosetting plastics require temperatures well above 300° sometimes dangerously approaching the charing point of wood

2 Sub-assemblies may be pre-molded, trimmed and fitted, then again molded as an integral part of larger complex structures

3 Most of these resins are transparent—therefore, the wood grain can be inspected during all phases of assembly

4 High pressures during cooking process are unnecessary—thus inexpensive mandrels may be employed.

The "Vidal Process" as developed by Aircraft Research Corporation aptly meets these requirements

Primarily the "Vidal Process" is a method of molding under fluid pressure and heat, plastic impregnated sheets of veneer which have been placed on properly contoured and slotted wood forms The "cooking" process welds and presses a *reinforced* structure, skin ribs, stringers, sills pads and other members, into a single homogeneously bonded unit The process is rapid and simple, therefore economical and highly adaptable to mass production Molded structures are uniform, fulfilling a prime necessity in production Double curvatures encountered in aircraft structures can be readily molded at no additional cost—hence structures of high aerodynamic efficiency can be easily attained The impregnated wood affords a paint surface of mirror finish resulting in substantial reductions in skin-friction drag Deflections while structures are under load are uniform with complete absence of rippling thereby affording retention of true airfoil contours This factor alone is becoming of greater significance in the light of recent investigations in boundary layer and its control

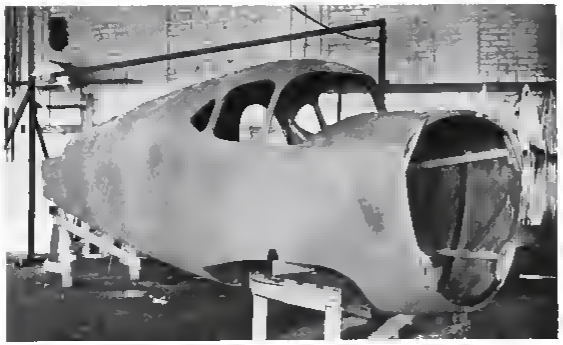
Of considerable importance are the cost economies accruing to the process in that pre-molded structures supplementary to the skin are simultaneously attached, thereby eliminating many assembly steps Specialized and highly skilled labor is unnecessary as any competent wood-worker is qualified to join and fit sundry wood or veneer pieces

Static tests on molded aircraft parts covering the Summit airplane which were recently conducted for the Civil Aeronautics Administration, attest to the enormous strength of molded materials Although impregnated veneers are found to have an overall strength approximately 17% greater than wood itself, this factor is disregarded in stress analysis Extensive shear tests reveal average shear values of 750 p.s.i. are obtained However, in the Summit airplane glue lines are conservatively stressed not to exceed 250 p.s.i

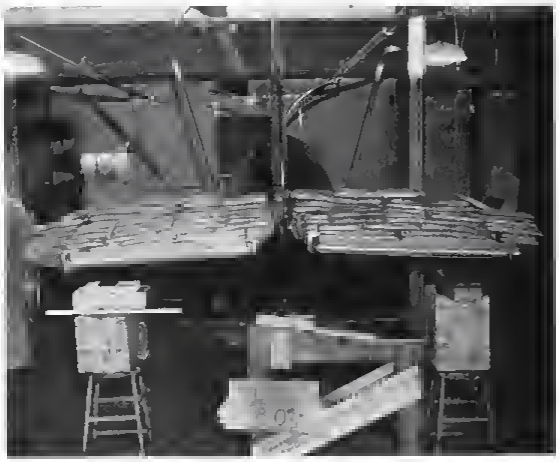
Description of the Summit Model HM-5

Model HM-5 is a low wing Cantilever monoplane of 1350 pounds gross weight and the subject test model is powered with an A-75 Continental engine having been flight tested by the writer in April, 1940 Performance figures cannot yet be released

(Turn to page 144)



The fuselage of the Summit HM-5 when it comes out of the mold is as smooth as a dining room table Notice the former rings and stringers that are all attached in one process and at one time.



During the static test the stabilizers loaded with 870 lbs of lead were stressed 120% of their designed load. Notice the high angle of the cowl raised at the front of the ship giving engine accessibility

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SAWING SPEEDS PER MINUTE

Thickness	Cast Iron	Cold Rolled	Tool Steel	High Speed Steel	High Chrome High Carbon
¾"	16"	9"	5"	2¾"	1½"
½"	8"	4½"	2½"	1½"	¾"
1"	3½"	2¼"	1¼"	½"	⅜"
1½"	2"	1"	⅝"	5/16"	3/16"
3"	1"	½"	5/16"	5/32"	3/32"
6"	½"	¼"	5/32"	5/64"	1/32"

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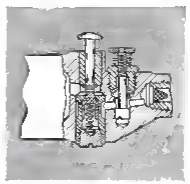
With so much at stake in the national defense program you cannot afford to let assembly stall. Guard against that possibility by being certain that your portable power tools are doing their job swiftly and reliably. Thor Extra Light Riveting Hammers, like over 200 other Thor Airplane Tools, have been doing that kind of job for aircraft manufacturers for many years in normal times and will continue so in this time of emergency.

Here, outlined briefly, is technical information on Thor Riveting Hammers. For more complete details, send for Thor's new Airplane Tool Catalog.

Thirty Five Different Sizes of Thor extra light riveting hammers in five different handle styles provide precisely the right tool for every job. Both slow and fast hitting types are available for driving soft iron, dural, or aluminum rivets. Hammer specifications:

Capacities	3/32" to ¼" rivets
Bores	⅜" to 31/32"
Strokes	15/16" to 6"
Lengths	6⅛" to 17¾"
Weights	1⅝ to 7¾ lbs.
Throttles	Grip, lever, button, pistol, offset



The Thor Throttle Valve Regulator shown at left, is available on many Thor Riveting Hammers. It permits the operator to increase or decrease the amount of air fed to the hammer to any degree without loss of graduated throttle valve control.

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Los Angeles, Calif.
Philadelphia, Pa.
San Francisco, Calif.
London, England

A Plastic Airplane

(*Continued from page* 140)

Wind tunnel investigations were made to select a proper wing-fuselage combination for a perfect combination of dynamic stability and low-overall drag. Elliptical sections were used throughout the fuselage, which give ample cabin room, yet permitting a fuselage form of low parasite drag. The wing incorporates NACA 23015 airfoil at the root section tapering in both plan and thickness ratio to NACA 23012 section at the tip. High tip thickness ratio, coupled with effective leading edge slot and vented flaps have proved very efficient.

The fuselage is semi-skin stressed and incorporates laminated stiffening rings which are pre-molded and four longerons through which engine loads are distributed into rings and skin. The firewall bulkhead contains engine mount fitting pads molded simultaneously with the ring. Reinforced stainless steel firewall is provided. The cabin entrance door is molded with fuselage as are its reinforcements and stiffening pads. Windows, door and windshield sills are molded, the cutouts and contouring being done during assembly. Fuselage is made in two halves. Pre-molded structures fit into their respective slots, then after laminated impregnated skin is applied, the structure is processed as a whole.

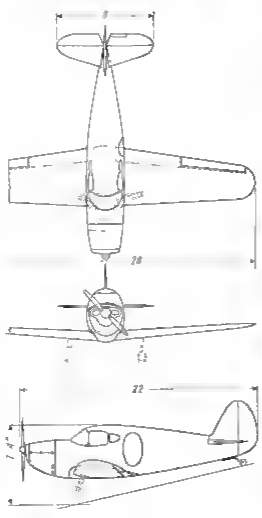
The HM-5 wing is of single spar construction. Spar location is at the 25% chord point. Torsion is taken out and transmitted into the fuselage through a molded flanged false spar located at the 75% chord point. The single box spar is built around spruce beams and mahogany webs. The spar is truly molded as no nails, screws, tacks or other fastenings than the plastic bond are employed. The wing consists of three pieces—leading edge, spar and trailing edge section containing false spar. Molded simultaneously to the leading edge and trailing edge pieces are the ribs, stiffening pads, etc., incidental to completing the structure. Ribs are pre-molded during which operation flanges and supporting moldings are attached. The rib forms drop into their respective positions in the assembly mandrel and the skin is applied layer by layer to the proper number of laminations and in the proper grain direction. The whole is then "cooked", becoming a homogeneous welded piece. In final assembly the pieces are plastically joined at the spar. Ailerons, flaps and tail group are molded in the same manner. For dynamic reasons ailerons are fabric covered.

The HM-5 retractible landing gear is irreversible and hand operated. The design utilizes a worm and quadrant system, the two sides being connected by a torque tube on which tube is installed a sprocket and chain system to the retracting handle located conveniently to the pilot and passenger. Wheel loads are transmitted into the wing by an axle attached at the main spar and false spar. Shock cord counter balances are provided so that the only load during operation is the frictional load to operate the system. The spring and oil shock strut of Summit's design and construction has proven highly satisfactory. A position telltale is located in the cabin and positive throttle lock is installed which prevents pilot from fully closing throttle unless gear is down.

Fittings, brackets and other metal parts are constructed of 4130X chrome molybdenum steel sheet or tubing. Control surface brackets are cast and contain Fafnir self-aligning ball bearings of 195-T4 aluminum alloy. A few specifications of the Model HM-5 are as follows:

Powered by Continental A 75

Dimensions	
Wing span	28 ft. 6 in.
Length O. A.	23 ft. 9 in.
Height	7 ft. 4 in.
Horizontal tail span	9 ft. 8 in.
Wheel tread	6 ft. 8 in.
Areas:	
Wing	130 sq. ft.
Ailerons	10 sq. ft.
Flaps	10 sq. ft.
Stabilizer	12.08 sq. ft.
Elevators	8.13 sq. ft.
Fin	6.5 sq. ft.
Rudder	7.57 sq. ft.



Automotive Methods

(*Continued from page* 122)

tool engineers in their analysis of the design are unnecessarily critical and do not fully appreciate its functional requirements. The tool engineer's attitude has justification and deserves explanation in that the recommendations based on the production studies of the part are influenced, if not wholly determined, by the quantity and type of machine tool equipment, the magnitude of the appropriations allotted for tooling, and to a very great extent, by the number of parts to be produced.

Often a slight change in a casting or forging, a modification to simplify basic design or increased tolerances, make appreciable savings in tool and manufacturing costs; also, attempts to reduce cost through redesign frequently result in seriously penalizing weight and performance, and is also closely related to serviceability since liberal tolerances, and in some cases, incomplete interchangeability, might be economical from a production standpoint but the cost of subsequent service because of such conditions might be excessive. Engine cowling is in this category.

However, it should be considered that the product engineer should not normally be fettered by precedent to the extent that the expression of ingenuity and invention in the design is restrained. Since frequently the development and perfection of new and original processes necessitated by engineering design, is distinctly advantageous in that if the idea "clicks" as it were, the competitors are handicapped in duplicating or approximating the new designs if a special process is vital to its fabrication.

(*Part II to run in an early issue*)

A piece of cellophane on top of a drop hammer die saves about fifteen cents in polishing labor.

AVIATION'S MARKET PLACE

Aeronca

AERONCA CHIEF 50 Continental 390 hours 92 since major New pyralin never damaged always hangared perfect condition throughout licensed privately owned Buying 3-place cabinship Cash $1050 trades considered Kurt Golda, Box 52, Shawano, Wis

Beechcraft

BEECHCRAFT 285 Jacobs, Curtiss-Reid propeller Two way radio Many other extras Just completely overhauled both plane and engine. $6,500 O J Whitney, Inc 9 Rockefeller Plaza New York, N Y Circle 6 7560

Beechcraft B17R Wright 450 Good shape $2500 00 Kergl Surveys San Antonio, Texas

Cub

1940 CUB COUPE, deluxe equipment dual Continental 65 Lear radio extra gas tank cream and Blue 100 hours, no student work, privately owned and hangared perfect condition Make offer Richard A Whitlock Middletown N Y

CUB J 3 38 Sport Topped in good condition Licensed $700 00 C F Littleton, Decatur, Ill

SACRIFICE TWO Brand New Cub Trainers Powered with dual ignition 65 H Continental motors Both airplanes equipped with tail wheels compass, cabin heaters just a few hours more than factory delivery time one ship with brakes. Airplanes now at Minneapolis. Wire or write General Air Transport Municipal Airport, Minneapolis, Minn.

Dart

DART MODEL G NC 20993 Lambert 90 licensed April 1942 310 hours total time Brakes, parts Perfect condition Cash priced $1850 00 FS 633 Aviation 520 N Michigan Ave. Chicago Ill (1)

Fairchild

1940 Fairchild Warner, all blind flying instruments, RCA radio compass, transmitter flaps pants generator sensitive altimeter, Bank and turn World except small late plane part payment Write Box 1756 Asheville N C

2 Fairchild 71's Wasp C, excellent Many extras $1600 00 each Kergl Surveys, San Antonio, Texas

Fairchild 42 Wasp B, good condition $1000 00 Kergl Surveys, San Antonio Texas

Fairchild 51-Wright J6 9 Perfect $1300.00 Kergl Surveys, San Antonio Texas

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FLEETWINGS 285 Jacobs Total time 320 hours. Constant speed propeller two way radio Excellent condition Price on request O J Whitney, Inc 9 Rockefeller Plaza, New York, N Y Circle 6-7560

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LUSCOMBE PHANTOM one of the latest A complete airplane needing no extras and in perfect condition Equipment includes all blind flight instruments, 2 yrs 2 way 1 earadio grimes lights 200 hours on engine 500 hrs on airplane. $2,750 cash William C Haines, 500 E Durham St. Philadelphia, Pa

LUSCOMBE 90 Warner engine dual ignition, brakes navigation, dash and landing lights electric starter radio receiver metal prop Licensed June '41 excellent condition, must sell Price $2400 W H Masters Rochester Medical School, Rochester N Y.

INDEX

AVIATION "Classified"—January, 1941

Underplayed ads offering only ONE make of plane are grouped under that make Others appear under "USED PLANES—General" and are numbered and indexed to enable readers to conveniently locate the makes of planes offered or other items of interest All other undisplayed and displayed ads—excepting those relating to employment and business opportunities—are numbered, or referred to by number, and indexed for the reader's convenience in quickly finding ads

Used Planes

Laird

LAIRD SPEEDWING SPECIAL, magnificent 450 H P Wasp Jr engine 3 hours since complete engine and airplane major overhaul White with green contrast Full tunnel cowling pants 1 struts turn and bank rate of climb manifold pressure suction gauge thermocouple Kollsman sensitive altimeter, carburetor air temperature outside air temperature, plus regular engine and airplane instruments, radio receiver automatic fire extinguisher, 12 volt battery Grimes retractable landing lights electric starter Ship in sparkling new condition—licensed to November 1941 Installed sky writing equipment—ready to write Speed 175 miles per hour—climbs to 10 000 feet in five minutes Priced to move $2 750 00 or trade for late model cabin airplane Write, wire or call General Air Transport, Municipal Airport, Minneapolis Minn

Rearwin

FOR SALE Rearwin 7000 excellent condition Little time from new $900 00 R M Spangler Jr 4000 Hamilton Ave Baltimore Md

Ryan

ST A RYAN Excellent condition approved for C P T secondary program Completely modernized airplane 300 hours since new engine Price for quick sale $3250 Lynn Air Service San Francisco Airport, South San Francisco, California

Stinson

STINSON SR 8B 245 H P Lycoming built and delivered in January 1939 Total airplane time 395 hours Five place insignia blue Leaning yellow trim Kollsman turn and bank, climb all standard engine and airplane instruments New RCA radio electric Lycoming Smith propeller This is practically a new airplane with small amount of time, always privately owned never used commercially Sacrifice for $4750 00 General Air Transport Municipal Airport, Minneapolis Minn

STINSON SR-5E landing lights flares, (5) RCA receiver this ship is in excellent condition $1850 00 Geo H Simmonds c/o Coopel Hangar, Municipal Airport KC, Mo

STINSON A TRI MOTOR low Wing 3 R 680 5's 10 PCLM Cabin carburetor heaters, water containers streamlined tail wheel with extra heavy duty tires. Hamilton controllable propellers directional gyro artificial horizon, full set of instrument flying equipment plus all engine and airplane instruments Argon lights, heavy gauge tanks complete sound proofing upholstering in perfect condition, definitely the Best Stinson low wing tri motor in the country—fast clean and dependable to be sold at $8930.00 General Air Transport Municipal Airport Minneapolis Minn

Taylorcraft

Taylorcraft 65 H P Lycoming De Luxe throughout manufactured August 1940 130 hours price $1700 00 E M Lynn 1000 R A Long Building Kansas City Missouri

Waco

WACO CABIN UKC NC5003 Transmitter receiver Full lights Flares New custom upholstery primary instruments Guaranteed 30 hours since complete engine major $2900 nothing less Skyhaven, Inc, Rochester, New Hampshire

1936 Waco SP Cabin fully equipped modernized and majored $2500.00 Hawke English Field, Amarillo Texas

WACO 1936 Standard 225 Jacobs Total hours 240 Privately owned Two way radio, special sound proofing Blind flying instruments Curtiss Prop Cruises 130 Beautiful appearance Licensed June 1941 Make offer F James Crownhurst, 35 Mill St, Belleville N J

WACO 285 WRIGHT Two position controllable propeller Two-way radio Total time 350 hours. Excellent condition, $3 800 O J Whitney Inc, 9 Rockefeller Plaza New York N Y Circle 6 7560

Waco

1933—Waco Cabin—Model U T C 210 Cont. 350 hours. Majored and modernized—topped 7 hours ago R C A receiver, generator, turn and bank rate of climb Landing lights flares pants. Ship in A-1 shape $1675 cash for quick sale

Used Planes—General

(See index on this page)
(See also Group Classifications)

CUBS: Many bargains, 1940 65 H P Coupe Dual ignition Continental fully equipped $1850 1939 Coupe 65 H P dual ignition Continental fully equipped $1650 1939 50 H P Continental Coupe fully equipped $1250 Warner 125 H P Monocoupe full instruments perfect $1425 1940 Trainer, 50 H P Franklin, A 1 condition $1098 New Standard $695 1938 40 H P Continental Trainer $650 Travelair OX5 $325 Kitty Hawk $695 All Sneneshie Bennet Air Service Hightstown (Cr'town) New Jersey No 1

USED PLANE BARGAINS Fairchild 1938 DeLuxe Warner, 325 hours total topped at 300. Ports Flaps generator, shielding new Lear receiver Stinson 105, 1939 privately owned flown only 118 hours cabin heater pants shielding receiver leather upholstering special red finish Stinson 105 Instrument Training Ship unusually completely equipped, little time since major Warner Super Scarab Engine 145Hp Serial SS592E 391 hours topped at 250 For complete information contact Waddell & Smith City Airport, Detroit Mich No 2

Engines & Parts

See also ads marked (P) in group Classifications

AMERICAN CIRRUS and Wright Gypsy Parts! Complete Stock of Brand New Cirrus and Gypsy Parts at 50% Discount Write Menasco Manufacturing Company, 6917 McKinley Avenue Los Angeles, California No 3

3 Wasp C motors—just overhauled and guaranteed $675 00 each Kergl Surveys San Antonio Texas No 4

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Aircraft Batteries

Aircraft Batteries rebuilt New plates and separators Your case, cover and posts Let us quote. Bowers Battery Mfg Co Inc Reading, Pa No 5

Cylinder Baking Oven

CYLINDER BAKING OVEN: Low cost Automatic time clock Low wattage Electrically operated Complete $39 50 Aeronautical Trading Co, Floyd Bennett Airport Brooklyn N Y No 6

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Parachutes bought, sold, serviced and rented New York Distributor for Irvin Air Chute Joe Crane, Roosevelt Field, Mineola L I N Y No 8

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1 Set Edo Pontoons practically new Came off of Fairchild 51 Airplanes. $600 00 Kergl Surveys San Antonio Texas No 9

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Skis CAA approved skis in three models for light aeroplanes Simple sturdy and light weight Priced from $35.50 up Used reconditioned approved skis for all sizes of aircraft Federal Aircraft Works Minneapolis Minn No 10

Tires

NEW TIRES—800 x 4 and 600 x 6 $10 00—Tube $2 50 Small mold blemish We guarantee serviceability not affected Sent C O D inspection allowed Becker Aircraft Supply Co, Bettes Airport, Homestead Pa No 11

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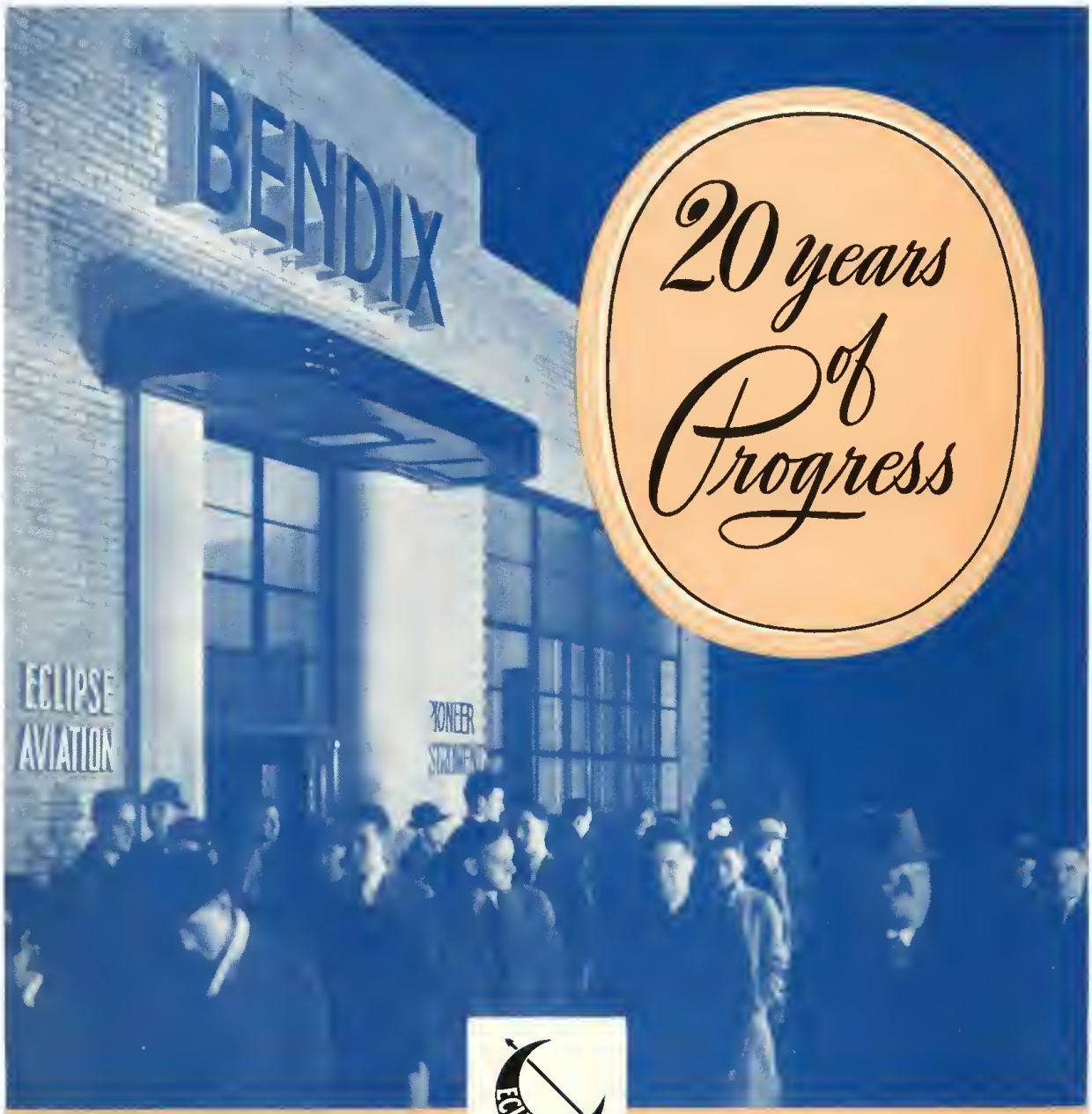

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